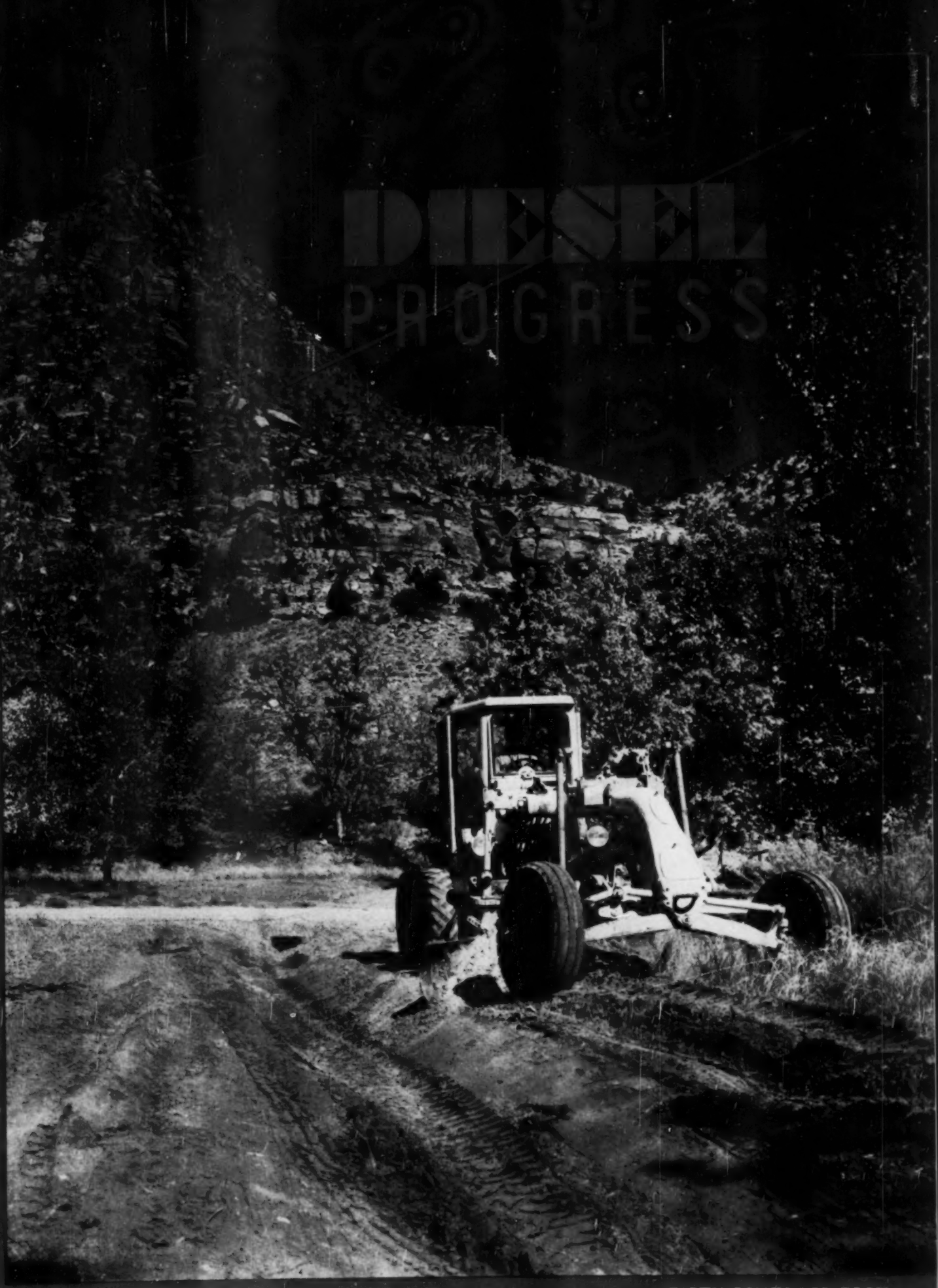
DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



FIVE DOLLARS PER YEAR

MAY, 1950

FIFTY CENTS PER COPY

DIESELS RUN

and fuel costs are less when you lubricate with Texaco Ursa Oils

ANY Diesel lubricated with *Texaco Ursa Oil* is bound to run cleaner because *Texaco Ursa Oils* have high resistance to oxidation . . . and are designed to keep harmful carbon, sludge and varnish from forming. So rings stay free, valves work the way they should, ports stay open . . . assuring better compression and combustion.

In addition, *Texaco Ursa Oils* maintain their tough lubricating films in spite of heat and high pressure. Wear all but vanishes. Bearings and all moving parts last longer. No wonder maintenance costs and fuel consumption are less when *Texaco Ursa Oils* are on the job!

There is a complete line of *Texaco Ursa Oils*. They are approved by leading Diesel manufacturers, and are easily America's favorite Diesel lubricants — as shown by the fact that *more stationary Diesel h.p. in the U. S. is lubricated with Texaco Ursa Oils than with any other brand.*

Get a greater return from your Diesel operating dollar. A Texaco Lubrication Engineer will gladly help you. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TUNE IN . . .
TEXACO STAR THEATER
starring
MILTON BERLE
on television
every Tuesday night.
See newspaper for
time and station.

TEXACO

TEXACO

DIESEL PROGRESS, for May, 1950, Volume XVI, Number 5. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 816 No. La Cienega Blvd., Los Angeles 46, Calif. Rex W. Waldman, President. Subscription rates $5 per year, single copy 50c. Acceptance under 34.64, P. L. & R., authorized.

CLEANER...

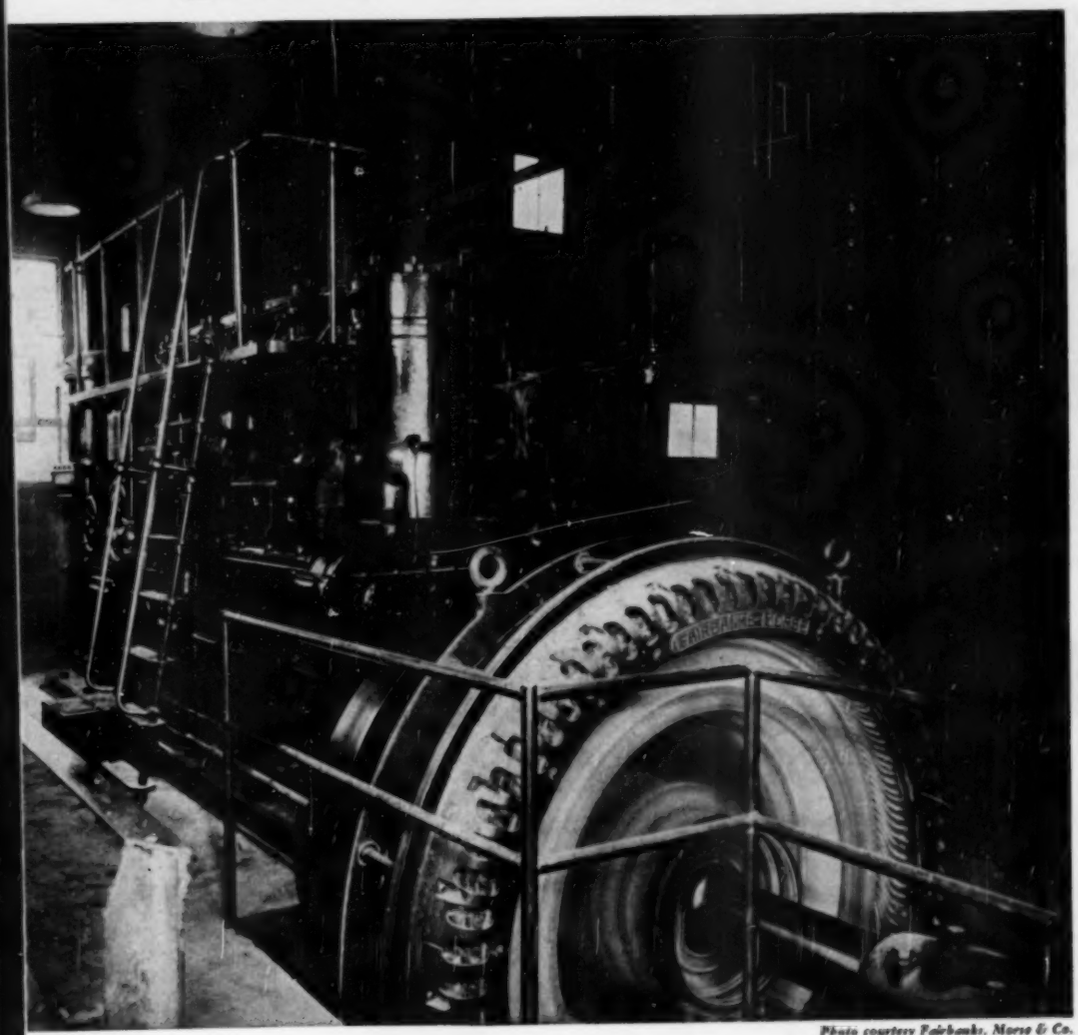
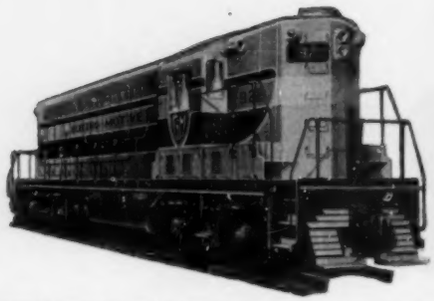


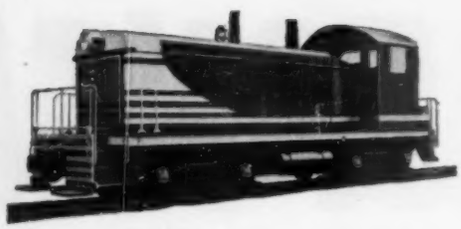
Photo courtesy Fairbanks, Morse & Co.

URSA OILS

FOR ALL DIESEL ENGINES

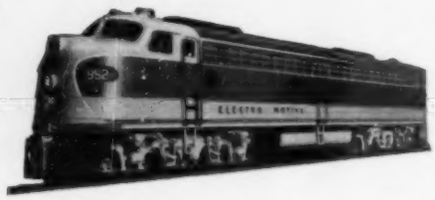


GENERAL-PURPOSE ROAD SWITCHER—This new 1500 h.p. road switching locomotive extends to branch line and local service the full savings which General Motors Diesel operation makes possible. This flexible, wide-range GP-7 unit can be used in local or mainline freight or passenger service, or both; in yard or wayside switching; in transfer, or helper service and in hump switching.



GENERAL MOTORS DIESEL SWITCHERS uphold the reliability tradition of GM Diesel freight and passenger locomotives on the mainlines. Speeding yard movements and cutting terminal delays, they have established unparalleled records for efficiency, long life and low operating and maintenance costs. Rugged 1200, 800 and 600 h.p. units cover all yard, terminal and transfer requirements.

COMBINATION FREIGHT AND PASSENGER—Here is the newest model of General Motors' versatile freight and heavy-duty passenger locomotive. Operating as a single unit of 1500 h.p. or in combinations of 3000, 4500 or 6000 h.p., the new F7 hauls 25 to 30% more tonnage, controls heavier tonnage with dynamic brakes, utilizes a broader range of Diesel fuels and provides increased train-heating capacity for passenger service.



HIGH-SPEED PASSENGER—Latest, highly improved version of the General Motors Streamliner series which have delivered hundreds of millions of miles of dependable, economical service on America's fastest-scheduled runs, the new E8 will haul longer, heavier trains at higher sustained speeds with a smooth, steady flow of 2250 h.p. from each dual-engine unit—12% more power than its predecessor.

FIRST CHOICE

OF LEADING RAILROADS

In General Motors locomotives, railroads have the best tool available to meet today's economic and operating problems.

Backed by fifteen years and more than 2 billion unit-miles of experience in every classification of service, these locomotives are rendering a level of performance and are accomplishing economies approached by no other railroad motive power.

That is why General Motors locomotives are first choice in the rapidly growing Diesel fleets of America's leading railroads.

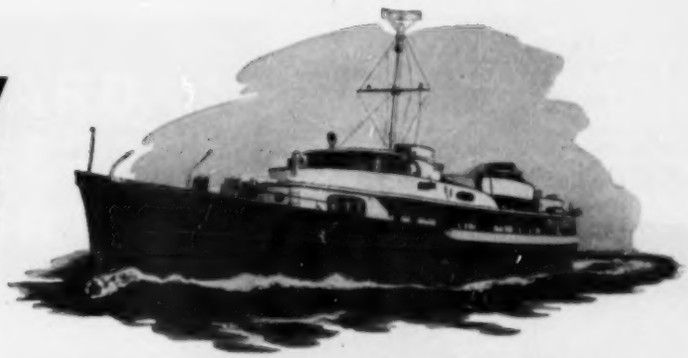
GM
LOCOMOTIVES

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS, LA GRANGE, ILL.

Home of the Diesel Locomotive

QUALITY

On the luxurious yacht, Haida, only the very finest equipment was installed throughout. Naturally Bendix-Scintilla was the choice for fuel injection.



DEPENDABILITY

A fire boat must be ready for action at all times. That's why Bendix-Scintilla Fuel Injection equipment was selected for the "Deluge", one of the largest and newest fire boats.

SERVICE

The longest towing job on record, 13,000 miles by the tug, Watch Hill, is another example of the unexcelled performance of Bendix-Scintilla Fuel Injection equipment.

BENDIX-SCINTILLA

FUEL INJECTION EQUIPMENT

See Our Exhibit at the Houston Industrial Exposition May 10 Thru 14, 1950

When any product is universally known for Quality, Dependability and Service, you can be sure that it has earned this reputation. Such is the case with Bendix-Scintilla Fuel Injection equipment. On the most demanding installations, as well as the routine jobs, the name Bendix-Scintilla has always stood as a steadfast guarantee of outstanding performance. It is our hope to continue to merit this confidence by building the absolute finest in Fuel Injection equipment.

SCINTILLA MAGNETO DIVISION of Bendix AVIATION CORPORATION
SIDNEY, N. Y.
Western States Office: 582 Market Street, San Francisco 4, California
Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, New York

NEW KICK IN THE OLD "MULE"

"Sheryl L" has two 6-cylinder GM Diesels driving twin 44" x 36" propellers through 4.5 to 1 reduction gears. Each engine is equipped with GM hydraulically operated reverse gears.

A FORMER U. S. Navy Sea Mule, the "Sheryl L", has been successfully converted to a river tow boat by Luhr Brothers, river contractors of Columbia, Illinois.

Sporting a pair of 6-cylinder GM Series 71 Diesel engines in place of the original power plants, "Sheryl L" attains speeds of 5 MPH upstream and 12 MPH downstream. She pushes a 38′ x 120′ barge, loaded with heavy equipment and supplies on the Mississippi and Missouri Rivers.

GM Diesels were a natural choice for this job because 2-cycle operation—power at every downstroke—makes them more powerful, more compact, easier to start and more responsive when maneuvering.

Whatever your need for power, you'll find it profitable to standardize on General Motors Diesels. Not only are they frugal with fuel, but these engines are long-lived, durable workers that are easy to maintain. See your local distributor, or write directly for further details.

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES... Up to 200 H. P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS... Up to 800 H. P.

GENERAL MOTORS

DIESEL BRAWN WITHOUT THE BULK

GM GENERAL MOTORS DIESEL POWER

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT R.P.M. Delo Oil

UNITS 148 Diesel engines

CONDITIONS Heavy-duty service 24-hour operation

PERIOD 13½ months

JOB L. A. Airport Extension

Engine-cleaning oil cuts "down time" in half!

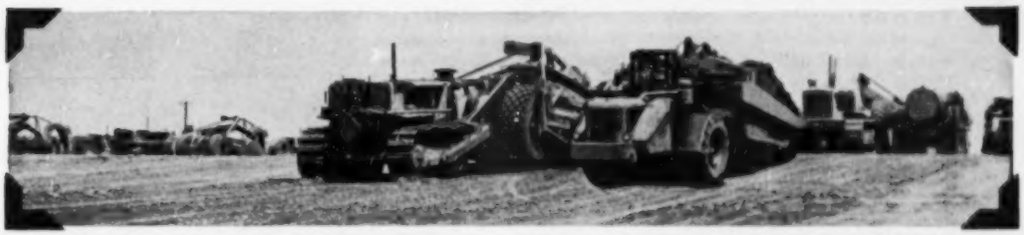
LUBRICATED WITH RPM DELO OILS, more than 100 heavy-duty engines like these were pushed to full capacity around the clock. They finished the greatest earth-moving project in the West 150 days ahead of schedule! RPM DELO Supercharged Oil kept parts lacquer-free and reduced wear so that time out for repairs was reduced 50% under that necessary when using ordinary heavy-duty oils.

How RPM DELO Oils reduce wear, corrosion, oxidation in Tractor, Truck, and other Heavy-Duty Engines

A. Contains special additives that provide metal-adhesion qualities . . . keep oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer . . . prevents ring-sticking. Detergent keeps parts clean . . . helps prevent scuffing of metal.

C. Special compounds stop corrosion of any bearing metal and foaming in crankcase.



HEAVY-DUTY DIESEL AND GASOLINE EQUIPMENT, owned by 8 contractors, moved over 12,000,000 cubic yards of earth on this cut and fill job—an extension to the Los Angeles Airport—in 13½ months! General Contractors are N. M. Ball & Sons, Berkeley; Harms Bros., Sacramento; H. Earl Parker, Inc., Marysville; Subcontractors, Lewis & Queen, Fresno; Louis Biasotti & Son, Stockton; Baker Bros., Chico; Gunner Corp., Pasadena; and Far West Construction Co. All used Standard Oil Company of California products 100%.

REMARKS: RPM DELO Oils are designed to meet every heavy-duty engine need: RPM DELO Heavy Duty, RPM DELO Special, RPM DELO Supercharged-1 and RPM DELO Supercharged-2 Lubricating Oil.

RPM DELO LUBRICATING OILS

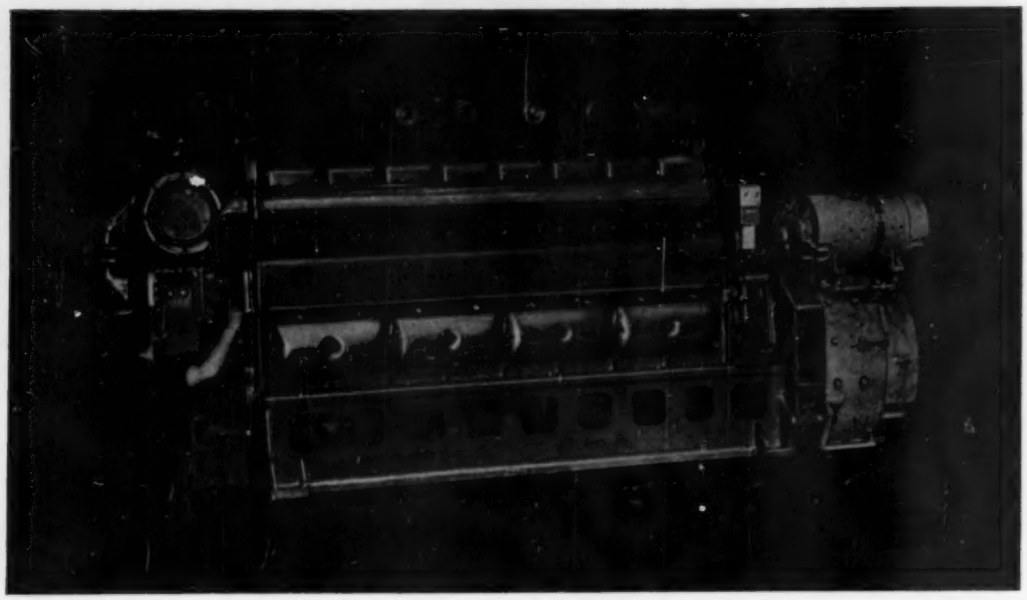
FOR MORE INFORMATION about the proper grade of the new RPM DELO Oils to fit your particular requirements, or the complete line of RPM Lubricants, and the name of your nearest "RPM" Distributor, write or call any of the companies listed below.

Trademark "RPM DELO" Reg. U. S. Pat. Off.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco — STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA OIL COMPANY • Barber, N.J., Chicago, New Orleans — THE CALIFORNIA COMPANY • Denver, Colorado

1200 *horsepower*

in a small package



This is the turbo-charged engine that is establishing such an excellent reputation for smooth horsepower, reliability and low maintenance costs in Lima-Hamilton's 125 ton railroad switcher. It develops 1200 bhp at 950 rpm — from eight in-line cylinders of only 9-inch bore, 12-inch stroke.

With over-all dimensions of only 13′ 5½″ length, 4′ 2¾″ width and 6′ 7″ height, it is as compact a heavy-duty engine as you will find. Weight is approximately 19,800 pounds.

This engine has a number of features that will interest any diesel operator: Major points, like intercooling of inlet air which produces lower temperatures throughout the cycle — and helps keep maintenance down. Little features, like the tell-tale holes that warn of any water leak which might otherwise reach the crank case.

Full information on this engine can be obtained through Lima-Hamilton offices in New York, Chicago and other principal cities, or by writing directly to Lima-Hamilton Corporation, 500 Hooven St., Hamilton, Ohio.

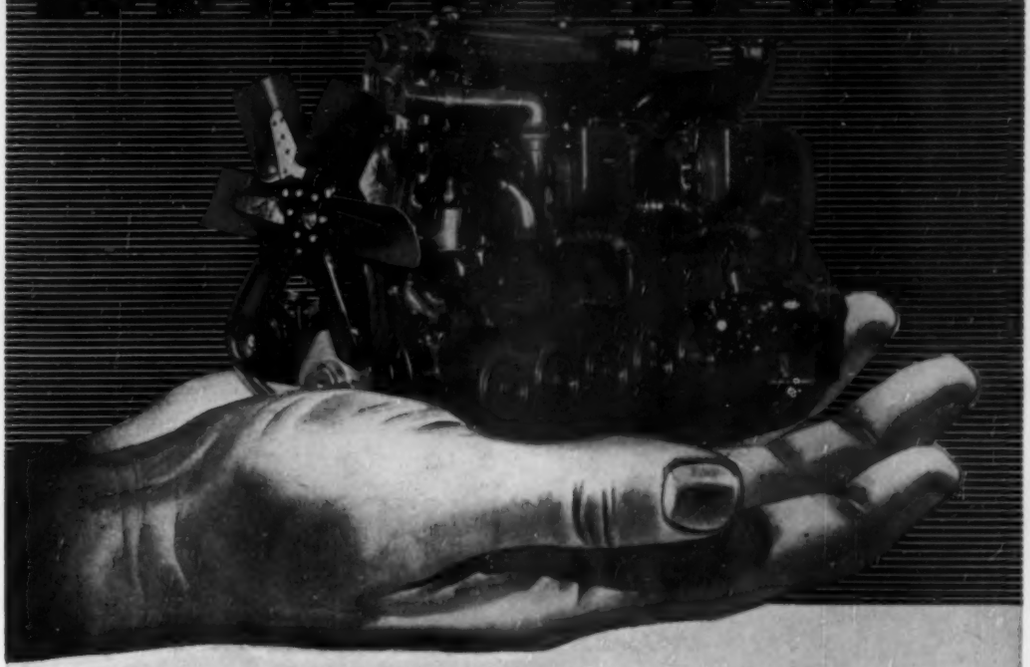
A six-cylinder version of this engine, developing 900 hp is also in current production. Both six and eight cylinder engines are available naturally asperated as well.

LIMA HAMILTON CORPORATION

DIVISIONS: *Hamilton, Ohio* — Niles Tool Works Co.; Hooven, Owens, Rentschler Co. *Lima, Ohio* — Lima Locomotive Works, Inc.; Lima Shovel and Crane Division. *Middletown, Ohio* — United Welding Co.

PRINCIPAL PRODUCTS: Hamilton diesel and steam engines, Niles heavy machine tools, Hamilton heavy metal stamping presses, Hamilton-Kruse automatic can-making machinery, Locomotives, Shovels and cranes, Special heavy machinery, Heavy iron castings, Weldments.

LIGHTWEIGHT



P&H DIESEL ENGINES

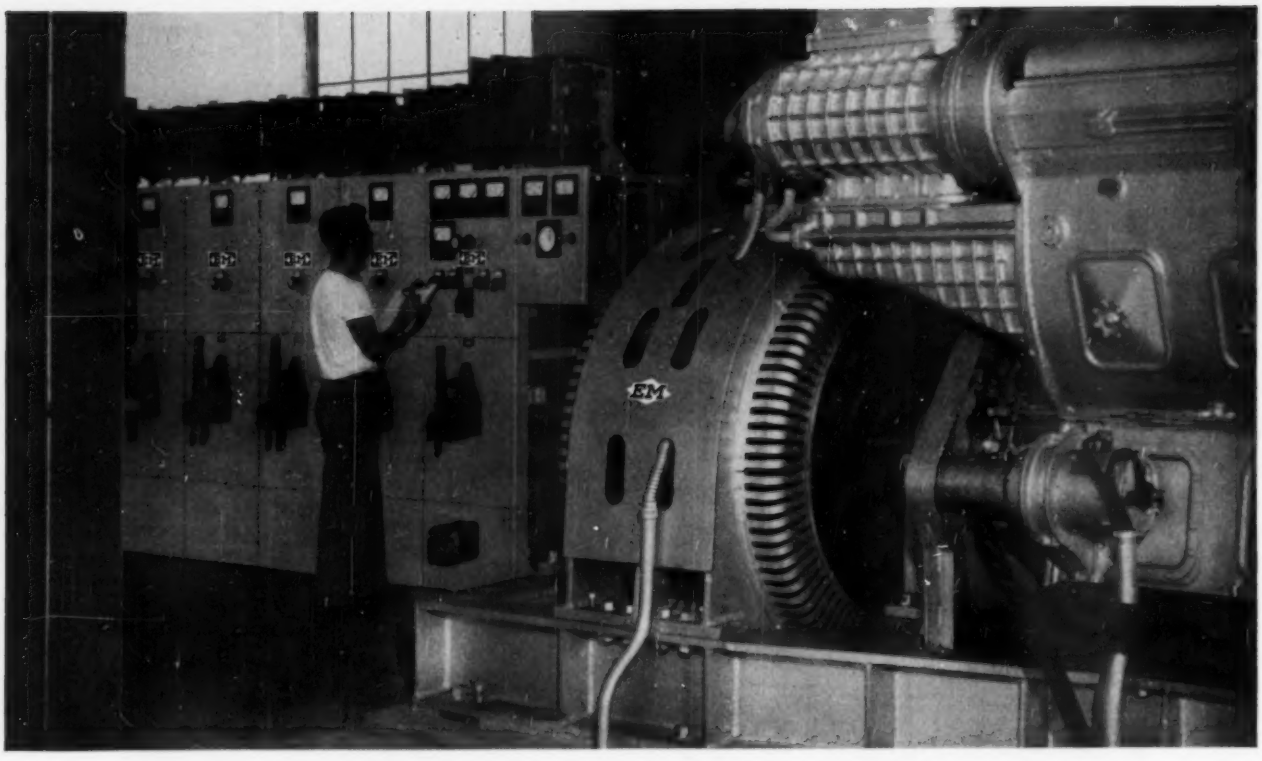
(2 CYCLE)

Now, for the first time, a line of diesel engines in which *all* major castings are of lightweight alloys. This is what you have waited for . . . *less weight per horsepower,* rugged design for the toughest jobs . . . proved performance. And longer life, too! Write for literature. Diesel Division, Harnischfeger Corp., Port Washington, Wis.

P&H DIESEL DIVISION

HARNISCHFEGER CORPORATION

PORT WASHINGTON P&H WISCONSIN, U. S. A.



E-M Matched Switchgear and Generators

SET NEW STANDARDS OF EFFICIENCY FOR MODERN POWER PLANTS

HERE is an example of matched E-M Switchgear and a 2400/4160 volt E-M Generator with a diesel engine in an upper Midwest Power Plant. The coordinated units give more satisfactory performance and smoother generation of electric power. There is greater dependability and economy.

In matched installations, factors to be considered are generator loading, power factor, motor starting, metering, voltage regulation, synchronizing and protection. These factors help efficiency and performance in your plant.

Consideration of these factors has lead to one pace-setting E-M development after another—Pre-engineered Switchgear with the advantages of custom-built gear and the economy of stock units—Generators that from their welded, rolled steel frames to their multi-layer coil insulation show the steady advance made by this company through a half century of building for year in and year out dependability.

This tremendous experience in meeting generator and switchgear requirements is available to you. E-M has field engineering and sales offices in 53 principal cities where competent advice is yours for the asking.

Talk to your nearest E-M field engineer or write to us for more details on matched generators and switchgear for your power plant.

ELECTRIC MACHINERY MFG. CO.
MINNEAPOLIS, MINNESOTA

2200-TPA-2090

E-M SPECIALISTS IN GENERATOR AND SWITCHGEAR ENGINEERING

Announcing

THE

Crofton

4 hp INDUSTRIAL

AIR COOLED

DIESEL ENGINE

- Displacement 30.7 Cu. In.
- Weight 235 lbs.
- Speed 850 to 2150 R. P. M.
- Power 3 H. P. at 1000 R. P. M.
  4 H. P. at 1500 R. P. M.
  5 H. P. at 2000 R. P. M.
- Rotation counter clockwise facing power output stubshaft
- Lubrication full pressure to all bearings by gear type oil pump
- Cooling AIR COOLED

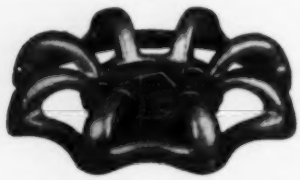
$275 LIST

Crofton

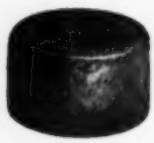
DIESEL ENGINE COMPANY

SAN DIEGO, CALIFORNIA

Toothed Lock Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.

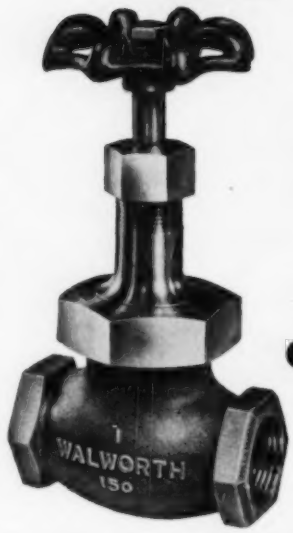


Newly Designed Handwheel: Air-cooled, finger grip handwheel affords sure grip even with greasy gloves.



Improved Packing: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure.

WALWORTH



IMPROVED

No. 95

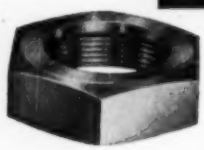
BRONZE

GLOBE VALVE

also available in Angle Type (No. 96)

The service ratings of the Walworth No. 95 are 150 pounds per square inch steam at 500F, and 300 pounds per square inch non-shock cold water, oil, and gas. In the manufacture of this quality bronze valve, more than 47 gages are used in machining parts to micrometric accuracy, thus insuring interchangeability of parts. For further information see your local Walworth distributor, or write: Walworth Company, 60 East 42nd St., New York 17, N. Y.

note these 7 Great Features



Hexagonal Union Bonnet Connection: Eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and assembled.

WALWORTH

valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

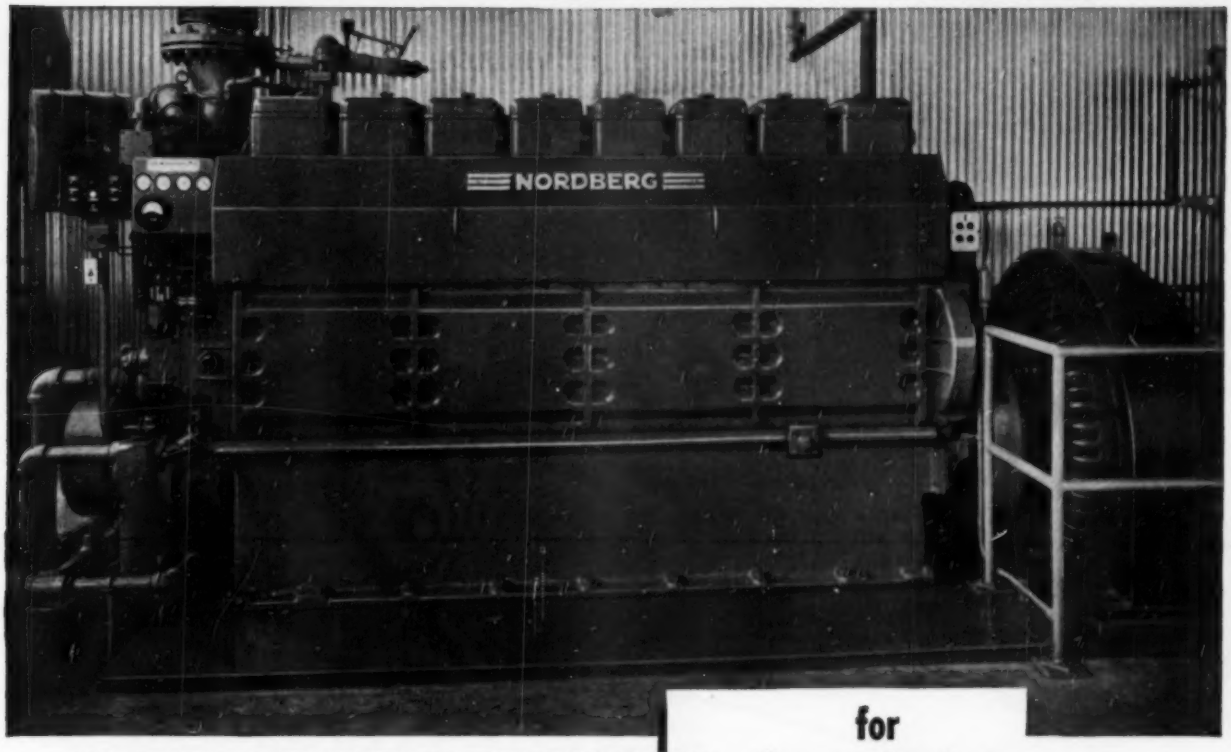
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

New Cylindrical Disc Holder: The design of the top portion of the disc holder keeps the disc accurately guided under all operating conditions.

Renewable Asbestos Disc: This disc is suitable for steam up to 500F and is resistant to oil, gasoline, and many chemicals at atmospheric temperatures. Discs for special services are available.

Extra Strong Body: Made of Composition M (ASTM B61) bronze thick enough to provide a high safety factor. Valves undergo hydrostatic shell test of 450 psi.

"Insurance policy" for *Glass Makers*



NORDBERG DIESEL for Owens-Corning Fiberglas

. . . THE CASE OF THE "STAND-BY" ENGINE THAT PAID FOR ITSELF IN ABOUT 5 MINUTES!

This 8-cylinder 720 hp. Nordberg Supercharged Diesel is connected to a 500 kw AC generator for emergency power needs at the big Owens-Corning Fiberglas plant at Santa Clara, California. With the process at this particular plant, an interruption of power for more than 5 minutes' duration could raise havoc with the processing machinery. To guard against any such shutdown caused by a failure of purchased power, the Nordberg Diesel is ready to take over the plant load at once. To make sure full power is instantly available, the engine is constantly maintained at operating temperature. Once each day the engine is started, paralleled with purchased power, and the plant load taken over for a short period . . . assuring its readiness, and familiarizing personnel with rapid operating procedure.

This emergency operation has already been handled once by the Nordberg Diesel, which has more than saved its original cost. Here, then, is proved Nordberg Dependability . . . *Ready for instant service.*

NORDBERG DIESELS FOR EVERY POWER REQUIREMENT . . . 10 TO 8500 H.P.

For regular or emergency service, you can't beat the advantages of Nordberg Diesels . . . they can be added to the line quickly, and can be held ready for instant service without exorbitant stand-by expense . . . and in the complete line of Nordberg two and four-cycle Diesel engines, including both oil and gas burning types, you will find exactly the right unit to meet your present and future power requirements . . . from 10 to 8500 H.P.

NORDBERG MFG. CO., Milwaukee 7, Wisconsin

P450

A DIVISION OF NORDBERG

NORDBERG

DIESEL ENGINES

That's the good word coming in from long-haul operators all over the country. Many of these Mack diesel owners find that Mack diesels pay back their extra investment in less than a year—in fuel savings alone.

Reporting on the cost-slashing performance of a Mack Model EQT diesel tractor, one mid-western hauler* says: "From the first day we put this diesel tractor in operation it has been averaging 8.6 miles per gallon, hauling 34,000 lb. payloads. Compared with a gasoline-powered tractor hauling the same loads, running side-by-side, this Mack EQT diesel is saving me far better than 50% in actual fuel costs. At this rate, our Mack diesel will more than pay for itself in no time at all."

Profit-making economy like this can be yours, too, when you switch to Mack diesels. Whether you operate in the 45,000 to 58,000 g.c.w. range, covered by the Model EQT—or up to 73,000 lbs. g.c.w.—there's a thrifty Mack diesel that will give you two-way savings in more miles per gallon at less cost per gallon. See your nearest Mack branch or distributor for a demonstration of what Mack diesel power can do for you.

*Name on request

MACK MODEL EQT DIESEL is proving the answer to lower fuel costs and increased profits for numerous operators in the popular hauling range—45,000 to 58,000 lbs. g.c.w.

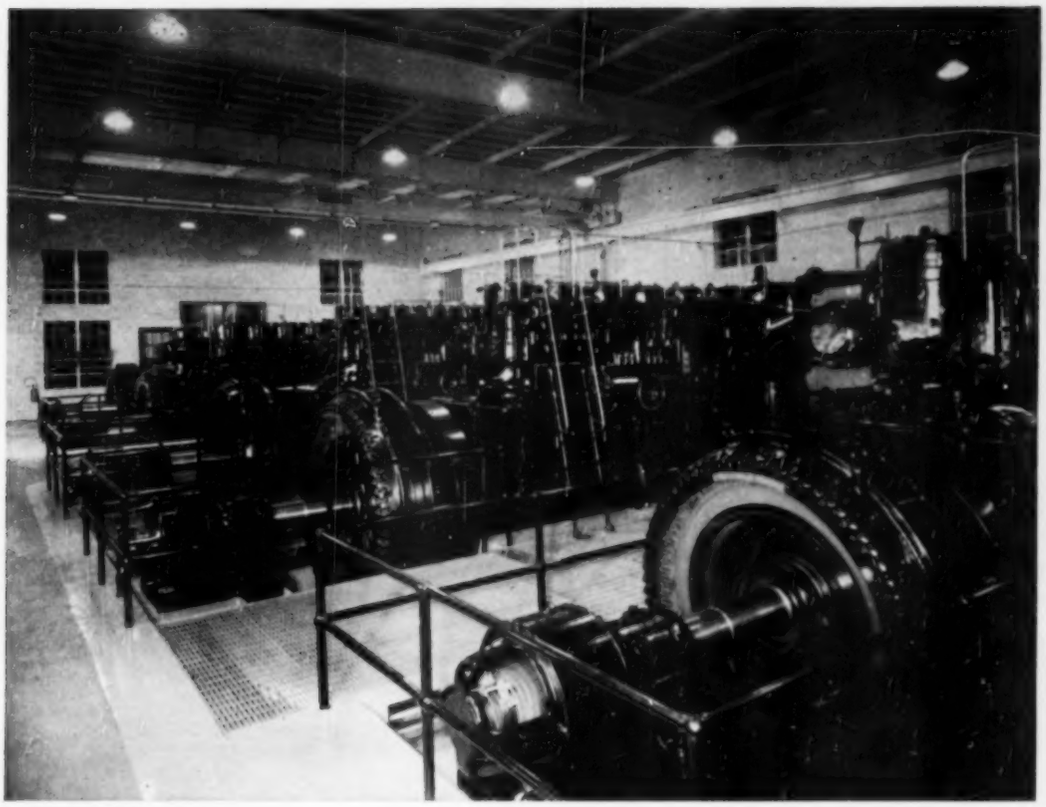
Be Profit-Wise

modernize with

Mack

...outlasts them all!

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.



NO lubricant change in 40,000 hours!

● A 10-cylinder 2,000-HP Fairbanks-Morse Diesel at the City of Jacksonville, Illinois, municipal power plant has required no change of its lubricant in over 40,000 hours of operation on STANDARD HD Diesel Oil. In all of this time, STANDARD HD has shown practically no deterioration. The engine crankcase has remained entirely free from deposits.

The piston rings in this same engine were in operation for 14,206 hours, and on inspection revealed not one broken or stuck ring. There was so little wear of the rings that, in most cases, the original tool marks were clearly visible.

Such lubricating efficiency is especially significant when the size of the Jacksonville plant is considered. Five F-M units, totaling 6,975 horsepower, a new 2,000-HP unit having been recently installed, make this plant one of the largest Diesel installations in Illinois. STANDARD HD in all units has helped keep maintenance costs at a rock-bottom low.

The experience of the Jacksonville plant indicates the savings you can expect to make by using STANDARD HD Diesel Oil. This truly heavy-duty lubricant owes its superiority to the combination of effective oxidation-resistant and detergent additives with solvent-extracted base stocks of highest quality. A Standard Oil Lubrication Engineer will help you obtain the best possible economy.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

Standard HD
DIESEL OIL

STANDARD OIL COMPANY (INDIANA) STANDARD

Diesel-Electric Drive towboat J. Rich Steers, owned and operated by Steers Sand and Gravel Corporation, New York City. Built by Gulfport Shipbuilding and Drydock Corporation, Port Arthur, Texas.

Powered by GENERAL MOTORS

OUTSTANDING addition to the world-wide list of vessel operators employing General Motors Diesel-Electric Drive is the Steers Sand and Gravel Corporation, New York City. By placing in service in New York Harbor the powerful, efficient tug *J. Rich Steers*, this company provides additional evidence of the confidence accorded marine power plants built by General Motors.

★ *Leader in Diesel engineering development for 38 years*

Cleveland Diesel Engine Division

CLEVELAND 11, OHIO

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

General Motors Diesel-Electric Drive has powered more than 700 vessels in 22 different classifications.

ENGINES FROM 150 TO 2000 H. P.

SALES AND SERVICE REPRESENTATIVES

NEW YORK, N. Y.
Cleveland Diesel Eng. Div.
General Motors Corp.
10 East 40th Street
New York 16, N. Y.

WASHINGTON, D. C.
Cleveland Diesel Eng. Div.
General Motors Corp.
504 Hill Building
Washington 6, D. C.

CAMBRIDGE, MASS.
Walter H. Moreton Corp.
9 Commercial Avenue
Cambridge 41, Mass.

NORFOLK, VA.
Curtis Marine Co., Inc.
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Norfolk 7, Va.

JACKSONVILLE, FLA.
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TAMPA, FLA.
General Eng. & Equip. Co.
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Tampa, Fla.

ORANGE, TEXAS
Cleveland Diesel Eng. Div.
General Motors Corp.
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Orange, Texas

LIVERPOOL, NOVA SCOTIA
Thompson Bros. Machinery Co., Ltd.
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Cleveland Diesel Engine Div.
General Motors Corp.
2315 North West 14th Street
Miami, Fla.

NEW ORLEANS, LA.
Cleveland Diesel Engine Div.
General Motors Corp.
727 Baronne Street
New Orleans 12, La.

SEATTLE, WASH.
Evans Engine and Equip. Co.
1230 Westlake, North
Seattle 9, Wash.

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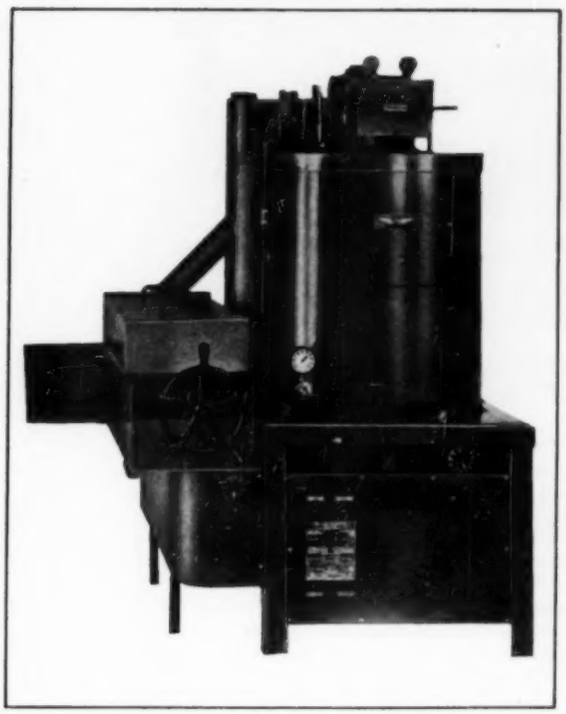
Hoffars, Limited
1790 Georgia St., West
Vancouver, B. C.

SAN FRANCISCO, CALIF.
Cleveland Diesel Engine Div.
General Motors Corp.
443 Harrison Street
San Francisco 5, Calif.

WANT TOP GRADE OIL AT 5¢ TO 10¢ PER GALLON?

You get it with Youngstown-Miller Re-Refiner!



Oil never wears out!

The restored oil regains all its "new qualities"—can be used again and again with perfect safety. Oil becomes aged, tempered, stable. Original values of fire, flash, viscosity and neutralization number are reproduced. Many users tell us that oil is actually improved!

Contaminants removed, oil improved!

Here's how the YM Unit Charge Oil Re-Refiner works. Dirty oil is mixed with adsorbent earth, agitated and subjected to carefully controlled electric heat. After volatile contaminants have been driven off, the oil and earth are forced into a two-stage filter press, where all solids, including the adsorbent material, are removed. Oil refined by YM Unit Charge Re-Refiner is completely free of dissolved impurities, liquid contaminants of high boiling point and suspended impurities.

Savings pay for cost of machine!

Actual letters from satisfied users prove that restored oil protects machinery . . . curbs costly shutdowns . . . reduces repair bills . . . and THAT SAVINGS ON OIL PURCHASES SOON PAY FOR COST OF YM RE-REFINER.

Simple and Effective for:

DIESEL ELECTRIC PLANTS • DIESEL POWERED SHIPS • RAILROADS
ENGINE BUILDERS • FLEET OPERATORS • INDUSTRIAL PLANTS

Write For Proof Of Savings By Actual Users!

If you have in use 100 gallons of oil or more, MAIL THIS COUPON!

Walter Kidde & Company, Inc.
529 Main Street, Belleville 9, N. J.

YOUNGSTOWN-MILLER DIVISION

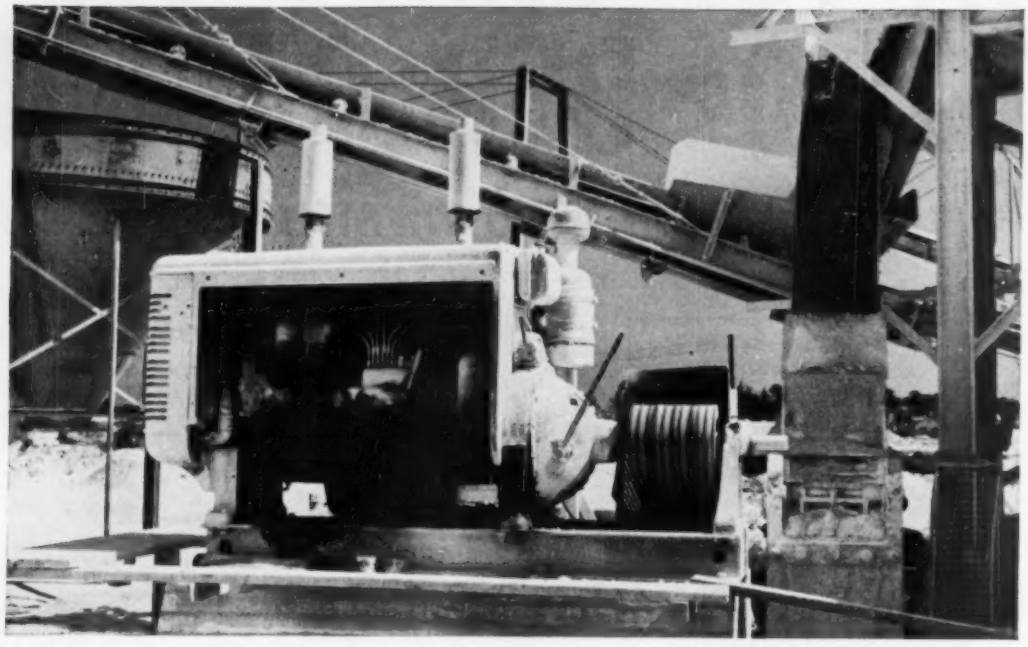
WALTER KIDDE & COMPANY, INC.
YOUNGSTOWN-MILLER DIVISION
529 MAIN STREET, BELLEVILLE 9, N. J.

Name of Company .....

Address .....

Type of Operation .....

I use ..... gallons of ..... (kind of) oil a month. Kindly send me, without obligation, complete information on the YM Unit Charge Oil Re-Refiner.



INTERNATIONAL POWER

"Pays for itself in Savings"

This is low cost power—both electric and direct drive—produced by International Diesels for the Miami, Fla., rock plant of the Murphy-Mills Corp. An International UD-24 and matched generator set delivers electricity for motor driven machines while the crusher is directly driven by an International UD-18A.

Superintendent G. L. Jones says, "We couldn't ask for better power at lower fuel and repair cost than we get from our Internationals. After two years of hard work, each engine had 3,000 work-hours and was hardly touched by the mechanic. A swell record. We are getting tremendous savings with our diesel-electric power over purchased electricity. It is the cheapest power we can get and the system will soon pay for itself in savings."

Solve your power problem the International way—the sure way to new low operating and maintenance costs. Let your International Industrial Power Distributor help you select the right International Power—for either diesel-electric or direct drive. Then watch your power pay for itself in savings.

INTERNATIONAL HARVESTER COMPANY • Chicago

Tune in James Melton and "Harvest of Stars," NBC. Sunday afternoons

CRAWLER TRACTORS
WHEEL TRACTORS
DIESEL ENGINES
POWER UNITS

INTERNATIONAL HARVESTER

INTERNATIONAL
INDUSTRIAL POWER

Dirt-Proof

your Fuel and Lube Oil
With AC Elements

FOR FUEL FILTERS

FOR LUBE OIL FILTERS

Millions of hours of service stand behind the AC Fuel Oil Elements engineered for factory equipment Diesel fuel filters. For their full life, these precision-built elements actually "Dirt-Proof" the fuel. As protection for fuel injectors and transfer pumps, AC Elements are unequalled.

Standard equipment on G.M.C. Truck and Coach, Flxible Bus, and Detroit Diesel.

AC Elements are also available for nearly every make of lubricating oil filter.

These AC Elements are so efficient that they "Dirt-Proof" your lube oil.

ONLY CLEAN OIL IS SAFE OIL!

AC OIL FILTERS

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

1600 Horsepower in 60 square feet!

Those interested in gaining additional power output without costly new construction should mark this:

Often the fact that Opposed-Piston diesel engines pack so much power in so little floor space makes it possible to increase plant capacity without expanding or remodeling the room or building now being used. For instance, a 1600 hp. Opposed-Piston engine can be installed on the same foundation required by the average slow speed engine of one-third the horsepower!

This is important—especially so when coupled with the facts that Opposed-Piston diesels have a world-wide record for low-cost, long-lived service, and are now available as dual-fuel engines for use with natural or sewage gas. Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE.

a name worth remembering

DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • PUMPS • SCALES
HOME WATER SERVICE AND HEATING EQUIPMENT • RAIL CARS • FARM MACHINERY

"ENGINE DOWN TIME... was ticking away like a taxi meter!"

"SOMETHING HAD TO BE DONE FAST. Production hold-ups were costing us plenty. We knew the trouble—improper lubrication—but after the most patient experiments with one lubricant after another we were still baffled.

"When down time really became critical, we called in a Cities Service Lubrication Engineer. This man knew Diesels from A to Z. He pointed out that the right grade and the right type of oil can easily make the difference between dependable performance and excessive down time.

"Without laying a wrench on any engine he diagnosed the problem quickly and accurately. His recommendations based upon his extensive Diesel experience and making use of his wide range of top quality Cities Service new Heavy Duty Diesel oils proved completely satisfactory. After six months of performance with a bare minimum of engine down time we are convinced the Cities Service Lubrication Engineer knew his business . . . and knew his products."

For the services of a skilled Cities Service Lubrication Engineer contact the office nearest you or write us for information. If you have a lubrication problem involving Diesel engines of any make or model, we'll be happy to discuss it with you.

A complete line of top quality lubricants

- **New Heavy Duty Diesel Oils**
- **Service-Proved Diesel Oils**
- **New Top Performance Diesel Fuels**
- **Exclusive Exhaust Analyzer Service**

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

FREE! THIS HELPFUL NEW BOOKLET

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Please send me without obligation your new booklet entitled "Diesel Engine Lubrication."

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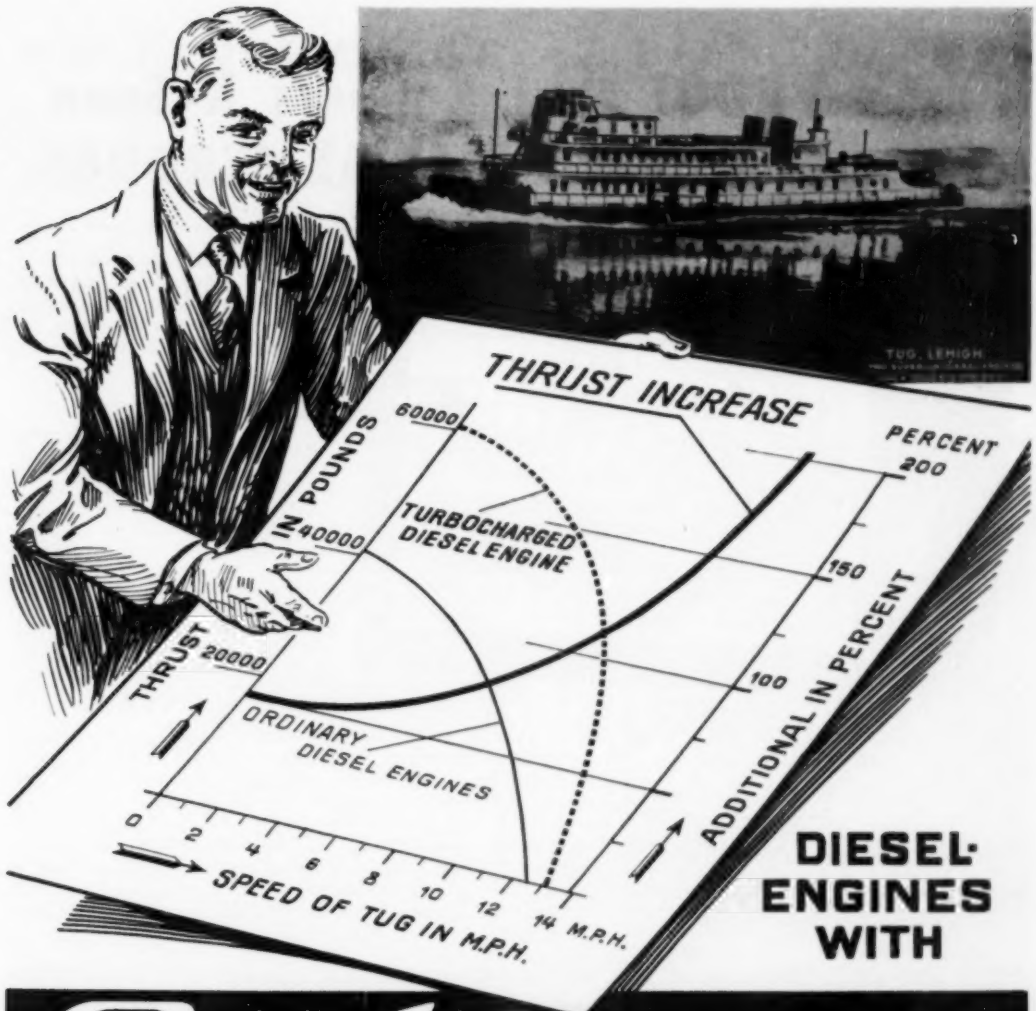
WHEN THE CHIPS ARE DOWN
AND THE GOING'S ROUGH ...

You can always depend upon
STEWART & STEVENSON *Service*

Stewart & Stevenson's factory-trained mechanics are always ready for your service call, ready *anytime*—night or day—regardless of where you may be . . . or what the circumstances. They drive fast panel trucks—fully equipped with all the necessary parts and tools to get your engine back on the line *in the shortest possible time.*

2060



DIESEL-ENGINES WITH

Buchi TURBOCHARGING

ITS OUTSTANDING EFFECT ON TUG PERFORMANCE

ENGINEERING-OFFICE **Dr. Alfred J. Buchi** WINTERTHUR·SWITZERLAND

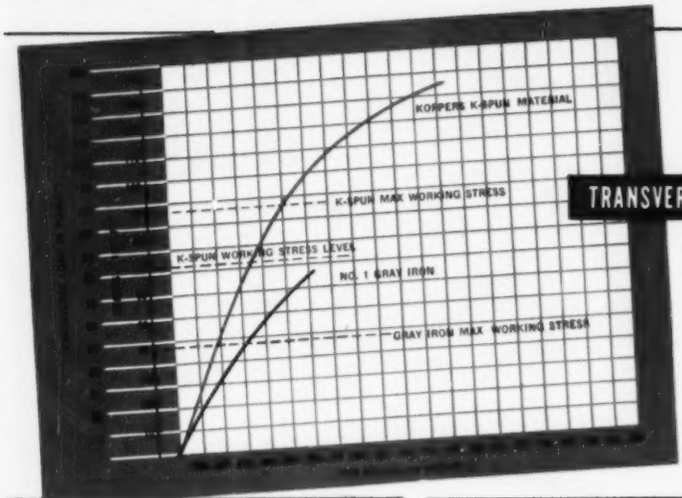
LICENSORS AND CONSULTING ENGINEERS FOR TURBOCHARGING OF NEW AND EXISTING INTERNAL COMBUSTION ENGINES

U. S. OFFICE: 707 MUNSEY BUILDING **WASHINGTON 4, D.C.**

Firms in U. S. building Oil Engines Exhaust-turbocharged on the Buchi-System:

American Locomotive Co., Diesel Engines and Turbochargers • Atlas Imperial Diesel Engine Co. • Baldwin Locomotive Works • Buckeye Machine Co. • Chicago Pneumatic Tool Co. • Cooper-Bessemer Corp. • Elliott Co. (Turbochargers only) • Enterprise Engine & Foundry Co. • Fulton Iron Works Co. • Ingersoll-Rand Co. • Lima-Hamilton Corp. • National Supply Co. • Nordberg Mfg. Co. • Sterling Engine Co. • Union Diesel Engine Co. • Washington Iron Works • Worthington Pump and Machinery Corp.

Here's PROOF that Koppers K-Spun Piston Rings are TWICE AS STRONG!



TRANSVERSE STRESS CHART

HERE ARE THE AMAZING RESULTS OF ACTUAL LABORATORY TESTS COMPARING ORDINARY GRAY IRON WITH KOPPERS K-SPUN, *THE MIRACLE METAL!*

Koppers K-Spun material shows a maximum working stress of 90,000 psi, compared with a maximum working stress of *only 40,000 psi for ordinary gray iron piston ring material!* Note the difference in the slopes of the two curves, due to K-Spun's increased modulus. K-Spun's yield point, though approaching ultimate strength, is low enough to allow a small percentage of elongation, resulting in toughness and impact value *many times greater* than that of ordinary gray iron.

TABLE 1—TRANSVERSE MODULUS AND RUPTURE STRESS

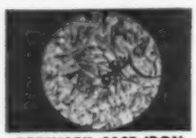
Koppers K-Spun Material			No. 1 Gray Iron		
TRANSVERSE MODULUS at			TRANSVERSE MODULUS at		
40,000 # psi	60,000 # psi	90,000 # psi	40,000 # psi	60,000 # psi	90,000 # psi
22.0×10^6	20.6×10^6	18.6×10^6	12.4×10^6	10.8×10^6	....
RUPTURE STRESS psi			RUPTURE STRESS psi		
138,000			67,000		

TABLE 2—HARDNESS, IMPACT AND TENSILE STRENGTH

Koppers K-Spun Material			No. 1 Gray Iron		
Hardness Rb	Impact in lbs.	Tensile Stren., psi	Hardness Rb	Impact in lbs.	Tensile Stren., psi
100-103	9.5- 9.5	75,400	102-104	2.5-3.0	42,000
99-100	11.0-11.5	72,900	103-104	2.5-3.0	40,000
103-106	7.0- 8.0	76,000	101-103	3.0-3.0	41,000
99-102	7.0- 8.0	79,100	103-105	2.5-3.0	42,000
99-100	8.5-10.0	76,500	104-105	3.0-3.0	42,300
103-104	6.0- 7.0	77,500	102-103	3.5-3.5	38,000
101-102	7.0- 8.5	73,000	104-105	2.5-2.5	40,000

IF you've had experience with Koppers American Hammered Rings in Diesel, steam or gasoline engines, you already have *proof of performance* of their superiority . . . now read for yourself these scientific facts and figures, verified by exhaustive laboratory tests . . . *positive proof that K-Spun Rings are 100% stronger, 50% more elastic, four times more shock resistant than ordinary ring material!* They're *guaranteed* not to break in installation or in service! Get the facts on Koppers Piston Rings today . . . write for complete information to: KOPPERS CO., INC., *Piston Ring Dept.*, 1535 Hamburg Street, Baltimore 3, Maryland.

K-SPUN IS AN ENTIRELY NEW, STRONGER KIND OF CAST IRON



ORDINARY CAST IRON

KOPPERS K-SPUN

These microstructures, magnified 250 times, show the basic difference between ordinary cast iron and Koppers K-Spun. Top photo shows individually cast gray iron, containing spiral flake graphite with long stringers in a fine pearlitic matrix. This fine flake graphite imparts to the metal many planes of weakness, causing low resistance to combustion shock.

Bottom photo shows K-Spun, cast by an exclusive centrifugal process. Note large nodular type of graphite formation and absence of stringers. Large graphite nodules eliminate the many planes of weakness inherent in most cast iron . . . double impact resistance and elasticity . . . increases wear resistance by far . . . in amazing Koppers K-Spun Piston Rings!

POROUS CHROME PISTON RINGS
. . . another Koppers Exclusive!

Koppers Porous Chrome Rings reduce cylinder wall wear 50% or more by actual test! Famous Van der Horst Plating Process provides a porous chrome surface that distributes oil for better lubrication during break-in, wears down to perfectly seated solid chrome that gives up to four times as much service between overhaul! For gasoline and Diesel engines (on specification).

KOPPERS

KOPPERS *American Hammered* PISTON RINGS

MACHINES OF GREAT PERFORMANCE

USE THE MOST DEPENDABLE OILING

SYSTEM EVER DEVELOPED

Madison-Kipp Lubricator Model SVH, providing controlled force-feed lubrication through non-clouding sight feeds to the cylinders of an Ingersoll-Rand XRE-1 Synchronous - motor - driven Ammonia Compressor. There are Madison-Kipp Lubricators for original standard equipment for almost every type of machine tools, work engines, and compressors.

MADISON-KIPP CORPORATION

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- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

SYNCHRO-START CONTROLS
FIT EVERY ENGINE REQUIREMENT

The control panel pictured above is that used for FIRE PROTECTION at many large manufacturing plants — air fields — hospitals — theatres — department stores — office buildings and which is accepted by Insurance Companies as wholly dependable protection.

Engines controlled by SYNCHRO-START have opened many new fields providing huge savings for the users of engine power as the main source, or as stand-by in case of emergency.

For the past eighteen years, SYNCHRO-START CONTROLS have been constantly rendering dependable service and protecting lives and property all over the world — on the seas, in the air, on land and in the mines.

The duty and functions of SYNCHRO-START CONTROLS are:

1. To automatically START an engine at a predetermined TIME or a CONDITION when power is needed, no matter what the application may be.
2. To automatically STOP that engine when its power is no longer needed and to have it ready for the next POWER DEMAND.
3. To automatically PROTECT that engine, its accessories and the *equipment* it is driving, against any abnormal condition that may cause *damage* while it is running. Also to indicate the cause of any trouble should it occur.
4. To afford valuable SAVINGS by having a DEPENDABLE source of power always available.

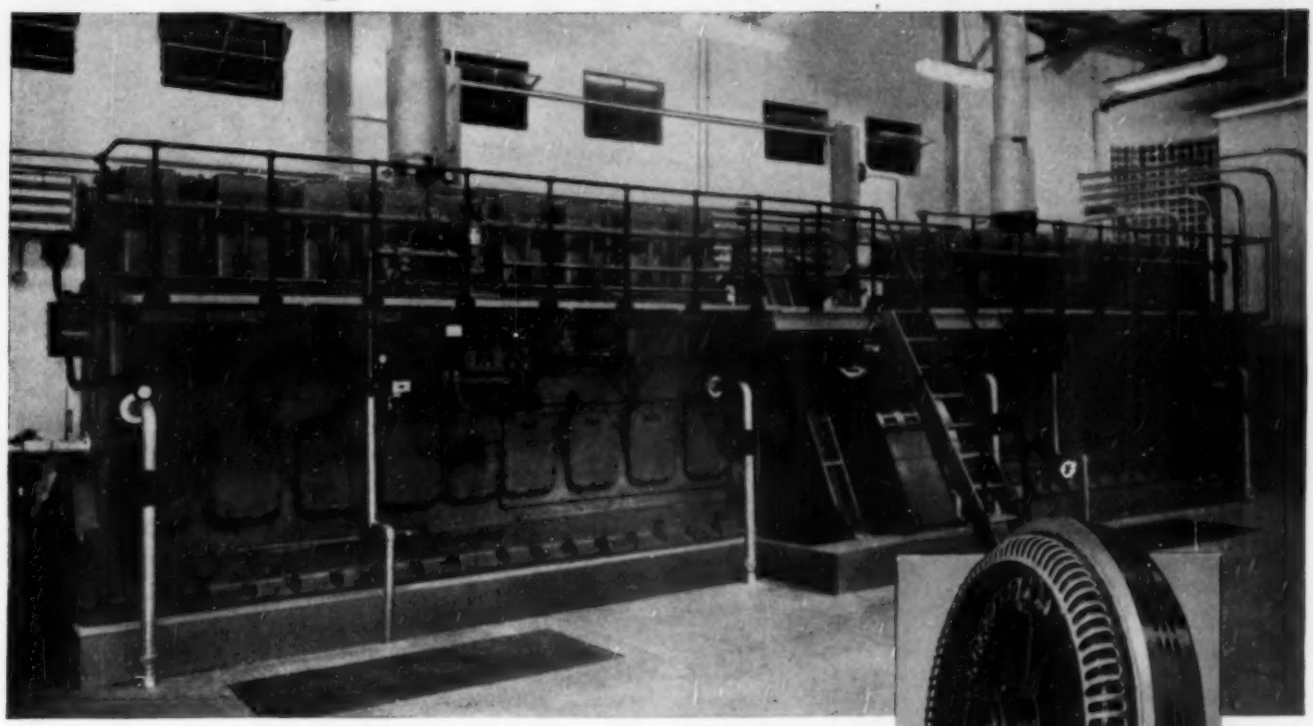
If you are not familiar with the SAFETY and the ECONOMY provided by SYNCHRO-START CONTROLLED ENGINES, ask your engine manufacturer—engine dealer—engineering firm, architect, or write to us for free information and our nearest representative.

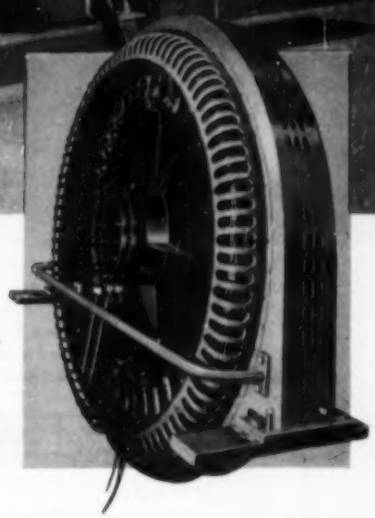
SYNCHRO-START PRODUCTS, INC.
1046 WEST FULLERTON AVENUE • CHICAGO 14, ILLINOIS

OVERSPEED GOVERNORS • SOLENOIDS • TIME ELEMENTS • RELAYS • SWITCHES • SAFETY CONTROLS • RECORDING CONTROLS • PRE-SET AUTOMATIC OR MANUAL CONTROL SYSTEMS FOR INTERNAL COMBUSTION ENGINES

YOU CAN BE **SURE**.. IF IT'S

Westinghouse





What you can't see...the PLUS added by Westinghouse Engineering

The only job of those big twin diesels, pictured above, is driving the Westinghouse A-C Generator almost lost in between them. An unusual installation—the first of its kind. Like many firsts, it too, presented problems. Insulating against the flow of shaft currents was one of them. Coupling the shaft looked like the answer—*if* an insulated coupling could stand up to the terrific driving force of the twins . . . *if* it lost no torque . . . *if* it could take it for at least a year without maintenance.

The engine builders asked Westinghouse, suppliers of the generator, to tackle the problem.

Westinghouse engineers designed an insulated coupling that did the job—and more, paving the way for future installations of this type.

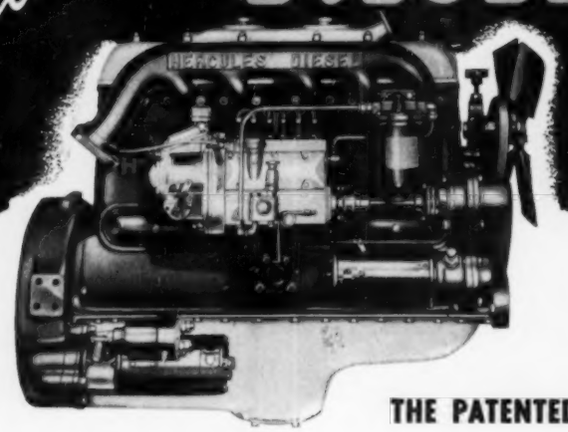
This example shows the problem-solving ability offered by Westinghouse in building special generators for unusual applications.

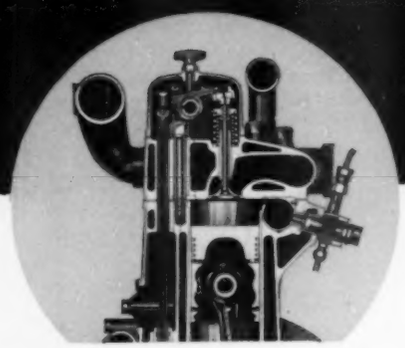
Make certain you get the benefit of Westinghouse engineering on your next equipment. Power Apparatus Specialists—in principal cities—will help you select and apply the right equipment to the job. Consult them for any present or future plans. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21571

Westinghouse

DIESEL ENGINE DRIVEN AC GENERATORS

Operating economy starts with HERCULES DIESEL ENGINES





THE PATENTED HERCULES COMBUSTION CHAMBER!

The universal acceptance of Hercules lightweight, high-speed, heavy-duty diesel engines is reflected in the sound engineering and outstanding design characteristics of the Hercules patented combustion chamber. It is designed to greatly increase the velocity of the air passing into the combustion chamber. When the air velocity reaches its maximum—fifty times crankshaft speed—the fuel is injected. This assures the complete mixing of the fuel and air, complete combustion at the right time and at the proper rate of burning. This results in: the highest possible expansion of the burned gases . . . exceptionally high operating efficiency . . . low fuel consumption—(since all fuel is completely burned) . . . clean exhaust . . . a minimum of smoke and noise. To install Hercules diesel engines is to secure the full benefits of the Hercules patented combustion chamber.

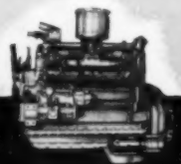
Hercules diesel engines are built in a broad range of sizes and displacements, from 12 to 500 horsepower, with automotive type of mounting or as enclosed, open or base type power units. They are parallel in mounting dimensions and performance with Hercules gasoline engines of similar displacement. Call in a Hercules engineer to discuss your future diesel power requirements.

Model	Bore and Stroke Inches	Piston Displ. Cubic Inches
TWO CYLINDER DIESEL		
DIXC	4" x 4½"	113.1
DIXD	4¼" x 4½"	127.5
FOUR CYLINDER DIESEL		
DIX4B	3¼" x 4"	133
DIX4D	3⅜" x 4"	166
DOOB	3¾" x 4½"	198.8
DOOC	4" x 4½"	226.2
DOOD	4¼" x 4½"	255
SIX CYLINDER DIESEL		
DJX6D	3⅜" x 4"	248
DJXB	3½" x 4½"	280
DJXC	3¾" x 4½"	298
DJXH	3¾" x 4½"	298
DJXHF	3¾" x 4½"	298
DWXC	4" x 4¾"	358
DWXCF	4" x 4¾"	358
DWXD	4¼" x 4⅜"	404
DWXDF	4¼" x 4⅜"	404
DWXLD	4¼" x 5"	426
DWXLDF	4¼" x 5"	426
DRXB	4½" x 5⅛"	474
DRXC	4½" x 5⅛"	529
DFXB	5" x 6"	707
DFXC	5⅛" x 6"	779
DFXD	5½" x 6"	855
DFXE	5⅝" x 6"	895
DFXH	5⅝" x 6"	935
DFXHF	5⅝" x 6"	935
EIGHT CYLINDER DIESEL		
DNXV-8B	5¾" x 6"	1247
DNXV-8C	6" x 6"	1348
DNXV-8D	6½" x 6"	1468
DNXV-8DS	6½" x 6"	1468

OUTSTANDING ADVANTAGES

- TOP OPERATING ECONOMY
- PROVEN PERFORMANCE
- LONG LIFE SERVICE
- SMOOTH FLEXIBLE POWER
- LOW MAINTENANCE
- HIGH-SPEED HEAVY-DUTY SERVICE

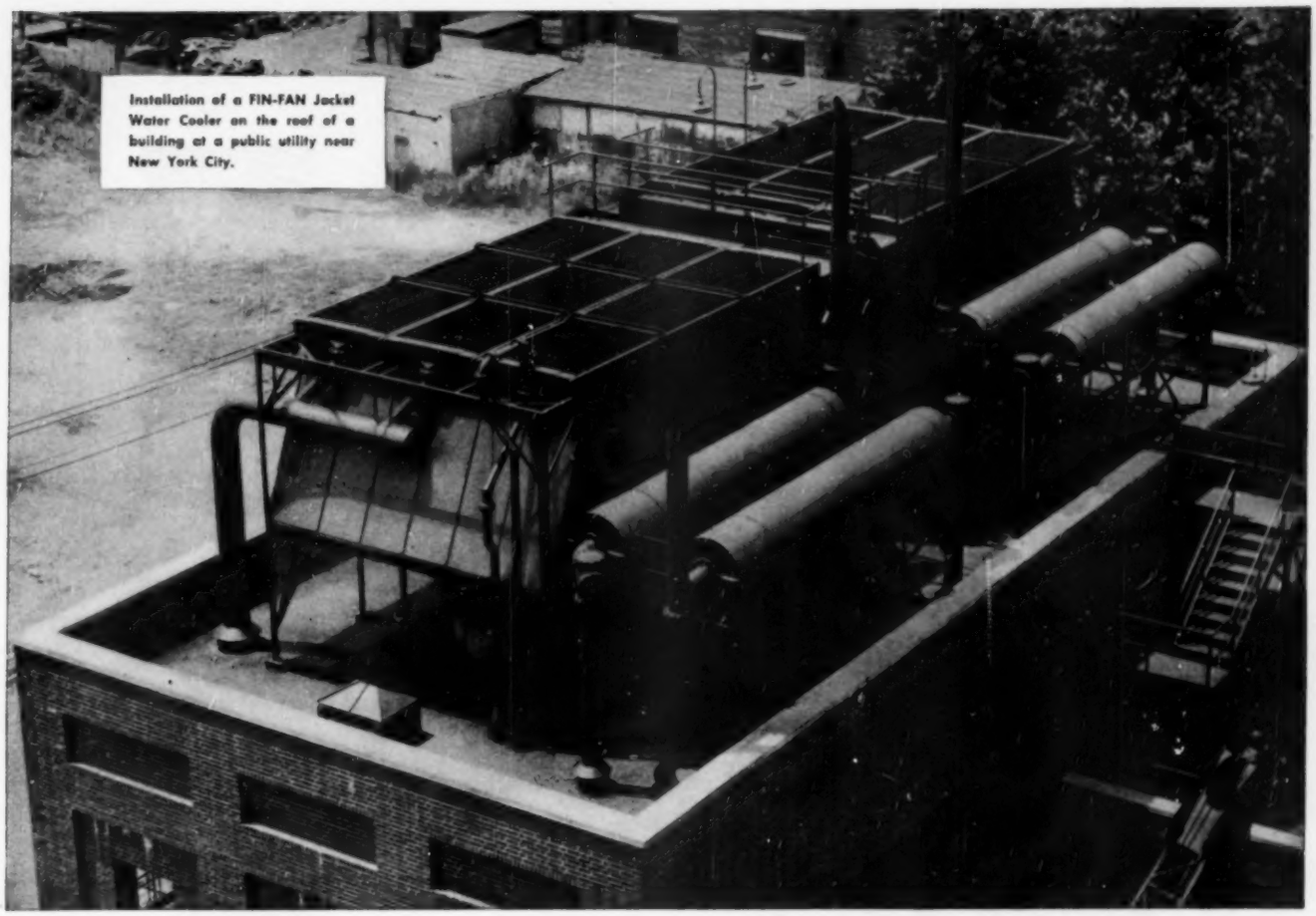
Model DNXV-8 Eight Cylinder Vee-Type


Model DIX6D Six Cylinder

Model DFXHF Six Cylinder Pancake Type

Model DIX4D Four Cylinder

HERCULES MOTORS CORPORATION • *Canton, Ohio, U.S.A.*



Installation of a FIN-FAN Jacket Water Cooler on the roof of a building at a public utility near New York City.

Cool jacket water

the modern way with

FIN·FAN air cooled exchangers

You eliminate your water problems and expenses, and assure uniform year-round effective jacket-water cooling at least cost when you use FIN-FAN Coolers.

These compact air-cooled heat exchangers, developed jointly by Griscom-Russell and Fluor Corp. Ltd., have proven their many advantages for jacket water cooling in more than 100 installations using over 500 G-R K-Fin Sections as the cooling unit. They can be placed wherever convenient . . . on a roof, on the ground or within a building . . . and operate independent of the direction or velocity of the wind.

Write today for bulletin on FIN-FAN and for complete information on application to your own Diesel engines.

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GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

From the Raw Material

to the Finished Product —

TAMING the "king of the jungle" from his wild, unfettered life on the veldt to please the patrons under the big top may be a far cry from producing a diesel crank . . . at first casual glance . . . but is it? Raw materials correctly selected, carefully blended, unceasingly controlled by metallurgical analysis reach the ingot stage here at Erie Forge Company . . . and then the skillful "whip" of engineering procedure begins to shape the steel for performance profitable and pleasing to power producing diesel engines . . . Watching each successive step from forging hammer, through machine shop to heat treating and soaking pits, Erie Forge "trainers" finally release the "King of Diesel Cranks" to do their bidding in harnessing the diesel's power for industry on land and sea. This unique "training", this refining, this "know how", is the priceless ingredient inbred in cranks, connecting rods, drive shafts and steel castings completely made within the walls of Erie Forge Company. Consult with us on your specification requirements—We can work together profitably.

ERIE FORGE COMPANY, ERIE, PA.

Where resistance to HIGH HEAT is essential . . .

GUN IRON CASTINGS

Where cast parts are subjected to high temperatures, Gun Iron and its alloys provide ideal properties. Basic Gun Iron maintains full tensile strength and hardness up to 850° F. and loses only 12% of strength at 900° F. By use of proper alloys this ceiling can be raised to 1000° F. In addition, growth is negligible up to 800° F. and amounts to only ¼ of 1% in linear dimensions at 900° F.

This unusual property of Gun Iron has solved many problems for users of industrial castings subjected to prolonged heats. Combined with superior resistance to frictional wear, erosion and corrosion, impact and pressure, it completes the requirements necessary for an iron that will give outstanding performance on the toughest casting assignments . . . and that is just what Gun Iron has been doing for over 139 years.

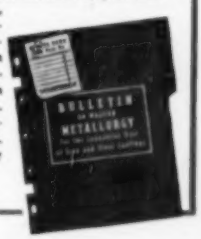
If these properties look like they can solve a design or maintenance problem for you, why not drop us a line. Our engineers, metallurgists and unexcelled laboratory facilities are at your disposal to help determine the specific economies of Gun Iron for your application.

GUN IRON *in the* DIESEL FIELD

Hunt-Spiller casts and machines many important diesel parts for leading diesel engine manufacturers. A few are listed below:

MAIN CYLINDER LINERS • CYLINDER HEADS • PISTONS AND H-S DOUBLE SEAL RINGS • WATER JACKETS • PRESSURE CASTINGS

Chances are that there are many other places where Gun Iron can solve a design or operating problem. To help you determine the value of Gun Iron for your cast parts, our metallurgical department has prepared a comprehensive bulletin which contains complete properties and discussions of Gun Iron and many other metals. Engineers claim it an invaluable reference aid. Send for your free copy today.



HUNT-SPILLER GUN IRON • HSGI • AIR FURNACE PROCESS

HUNT • SPILLER

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Canadian Representatives: Joseph Robb & Co., Ltd., 4050 Namur St., Montreal 16, P. Q.

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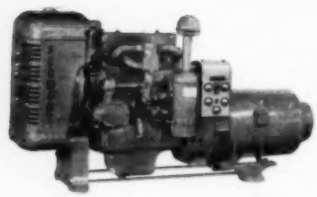
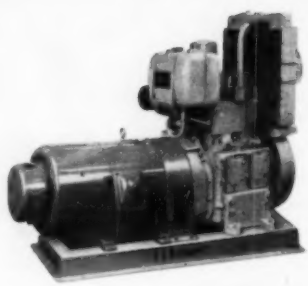


15 KW. GASOLINE GENERATOR SET



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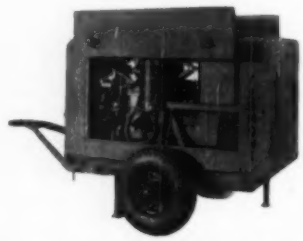

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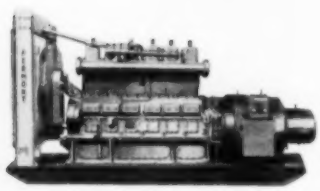
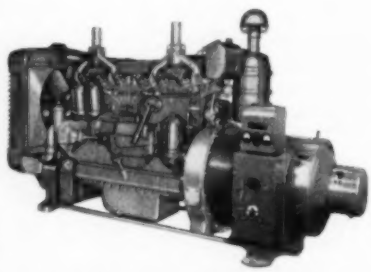


150 KW DIESEL GENERATOR SET



60 KW DIESEL GENERATOR SET

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CONTENTS FOR MAY, 1950

San Diego Sewage Treatment Plant 33
Ensenada, Mexico 36
Farmer Makes Diesel Tractor Work 39
Snoqualmie Falls Tree Farm Dieselizes 40
Diesel Pilot Boat 43
Stockton, Kansas 44
Diesel Shrimp Fleet 46
Diesels Speed the "American Way" 47
Bloomington, Illinois 52
Tuna Clipper *Hortensia-Bertin* 54
Pilot Injection for Diesel Engines 56
Newton Falls, Ohio 58
High-Speed Diesels—Design, Operation and Maintenance 60
Supervising and Operating Engineers Section 62
Exchange Your Diesel Maintenance Ideas 64
What's Going On in England 66

DIESEL PROGRESS for May, 1950, Vol. XVI, No. 5. Published monthly by Diesel Engines, Inc., 816 N. La Cienega Blvd., Los Angeles 46, California. Tel. Bradshaw 2-6273. Subscription rates are $5.00 for U.S.A. and possessions. All other countries $7.50 per year. Subscriptions may be paid the London office at £2-12s-6d per year.

DIESEL PROGRESS is indexed regularly by Engineering Index, Inc.

EDITORIAL AND PRODUCTION OFFICES

816 N. La Cienega Blvd. Los Angeles 46, Calif.

BUSINESS OFFICES

NEW YORK 19:
Robert N. Young
2 West 45th Street
MUrray Hill 2-7333

LOS ANGELES 46:
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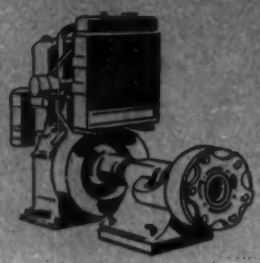
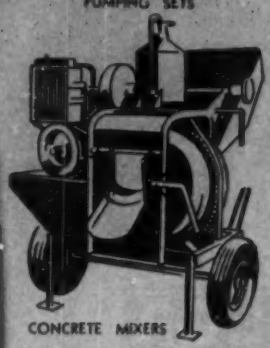
FRONT COVER ILLUSTRATION

An Allis Chalmers diesel grader maintaining the often-times perilous routes through Zion and Bryce National Parks in Southwestern Utah.

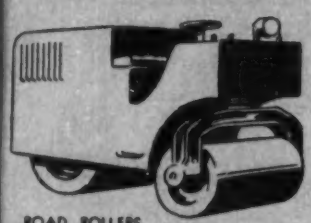
COMPRESSOR SETS



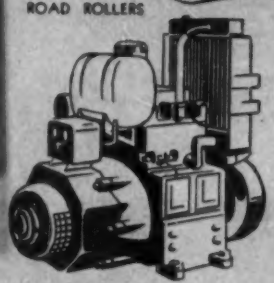
PUMPING SETS



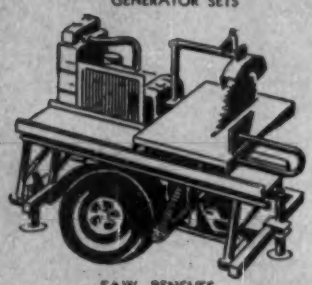
CONCRETE MIXERS



ROAD ROLLERS



GENERATOR SETS



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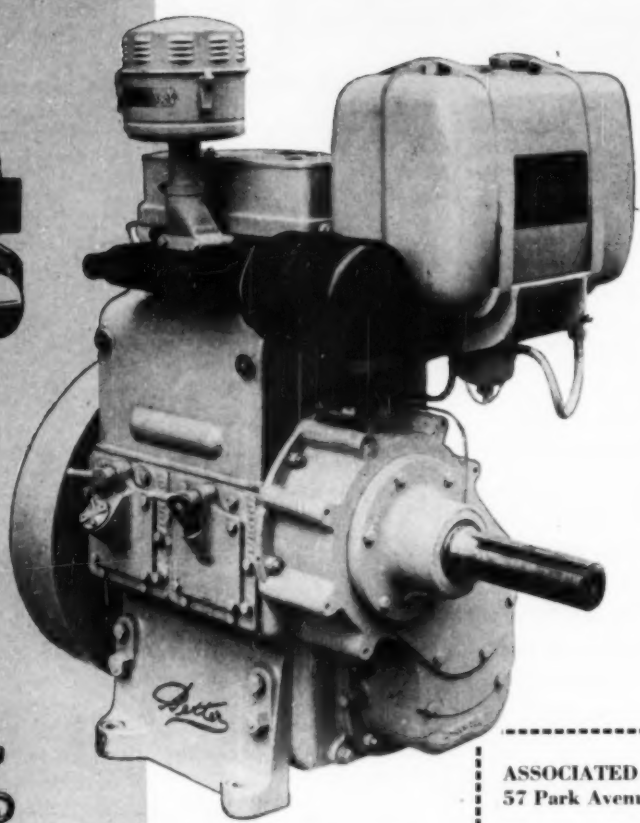

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VAPOR PHASE ENGINE COOLING AT THE SAN DIEGO SEWAGE TREATMENT PLANT

By FRED M. BURT

The San Diego, California, Sewage Treatment Plant Which Is Using the Last Word in "Vapor Phase" Cooling and Waste Heat Recovery

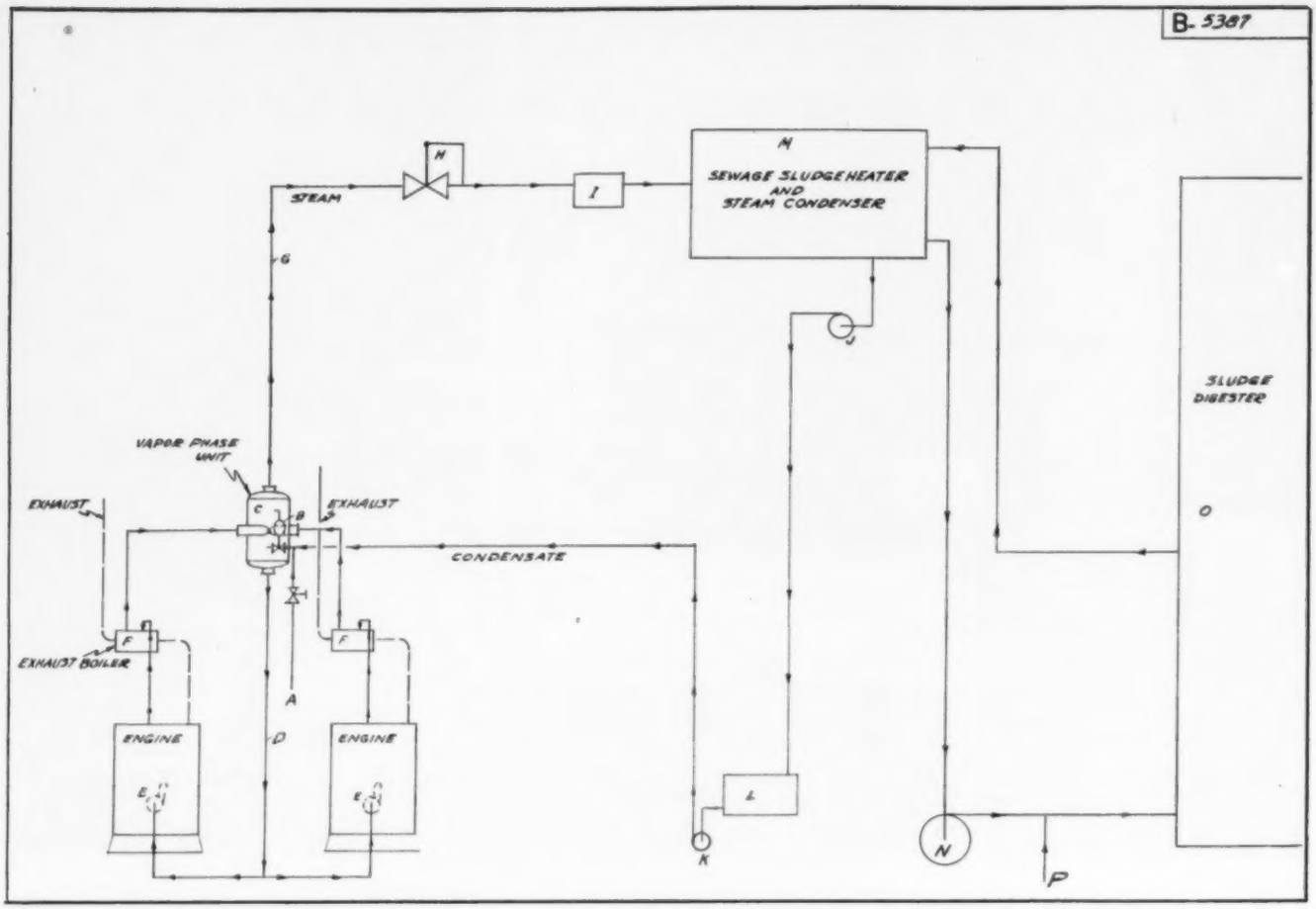
INSTALLED in one new power house at this plant are six Enterprise 6-cylinder, 12-inch bore by 15-inch stroke, sewage sludge gas engines, each rated at 350-hp. at 400-rpm. All six of the engines are air starting and employ the dry sump lubricating system. Oil is pumped from the base through primary filters to the service tank; the pressure pump regulates the oil pressure. Oil is cooled by heat exchangers with a by-pass for controlling the temperature. Oil pumps are gear driven from the camshaft gear train, and are located at the forward end of the engine. A gauge board is rubber mounted at the forward end of the engines also and equipped with all the necessary pressure gauges and an exhaust temperature pyrometer. The fuel injection pumps are individual for each cylinder and are operated directly from cams on the crankshaft. A common header supplies fuel to all the pumps. The discharge is through individual high pressure tubes to the respective spray valves in the center of the cylinder heads. Timing of the fuel injection is precision regulated by the design and position of the individual fuel cams. Four of the Enterprise diesels drive F-M pumps through Western Gear Works right angle drives pumping raw incoming sewage into clarifier. Two other engines, back-to-back with two of the first four (leaving space for possible future installation of the seventh and eighth similar units), drive two 7,500-cfm. Sutorbilt blowers to supply air for aeration prior to sedimentation. Prime purpose is for odor control. In the clarifier the heavy solids drop to the bottom where it is scraped into the center sump and from there the sludge pumps deliver it to the digesters. Small light particles and grease which float on top are skimmed off into traps by air jets and are then pumped to the digesters. After final treatment the effluent is pumped into San Diego Bay.

The sludge separated from the effluent is pumped successively into four large digester tanks where it is brought up to, and kept at about 95°F. temperature. This promotes the bacterial action which produces the raw sewage gas used as fuel for the engines. This bacterial working will continue for about 25 days. After its completion, the now virtually odorless sludge is pumped to a drying area, where it is turned over from time to time until thoroughly dried, when it is ready to be sacked and sold for fertilizer and soil conditioner. At the start of operations and until the sewage gas becomes available, the engines are using Butane fuel.

In order to maintain a constant supply of gas for the engines, as the sludge gas is successively produced from the different sludge digesters, a reserve supply will be built up in a gas holder reservoir.

The untreated sludge gas contains H_2S, which normally cannot be used in engines due to the corrosive effect on the cylinders, valves, etc. It also causes lube oil sludge. In the "Vapor Phase" system the engine circulating water is never cooled; therefore it must boil all of the time. The elevated water temperature prevents condensation from the product of combustion, as both inlet and outlet water is always at or above boiling temperature. Thus, the entire engine water jacket is above the dew point of the gases in the combustion chamber which dew point is in the order of 194°F. As the H_2S in the sludge gas requires the presence of moisture to make acid, this harmful effect is eliminated when "Vapor Phase" cooling is used. Expensive treaters to remove the H_2S and their maintenance are thus eliminated.

This "Vapor Phase" system is designed to recover all of the heat rejected to the engine jackets, radiation excepted, plus about 50 per cent of the exhaust heat. In order to capture as much radiated heat as possible, the V.P. units, exhaust boilers and all hot water and steam lines are insulated with 85 per cent magnesia covering. The recoverable heat from normally aspirated four cycle sludge gas engines when equipped with water cooled exhaust manifolds is in the order of 2,910 btu's per brake horsepower hour from the jackets, plus 1,455 btu's



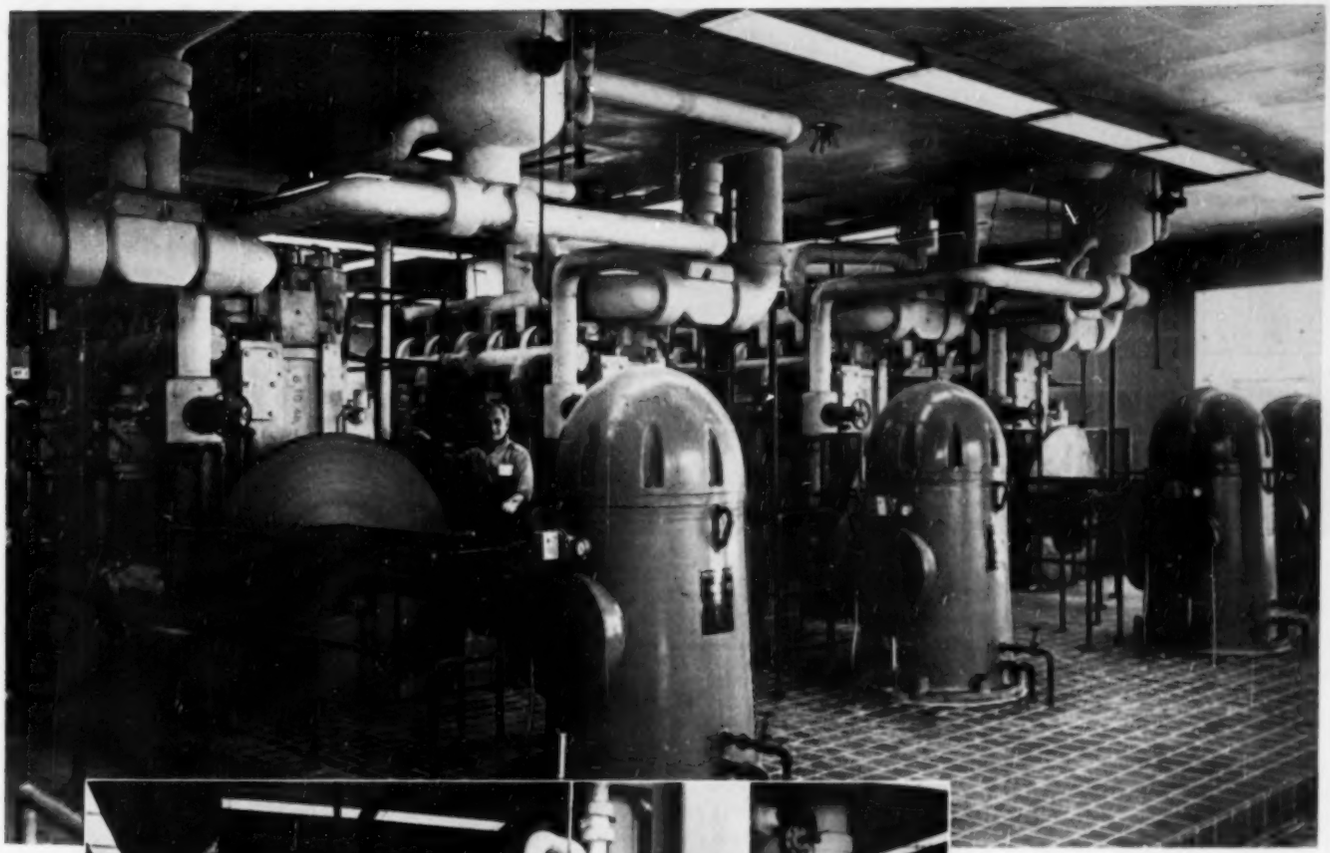
per bhp. hr. from the exhaust, a total of 4,365 per bhp. hr. The "Vapor Phase" system recovers this normally wasted heat in its most useful form, that is, low pressure steam. In this case, the steam pressure is maintained at about 5 psig. or 227°F. Each engine, when operating at full load of 350 hp., will generate steam at the rate of 4.5 lbs. or 4,365 btu.'s per bhp. hr., or 1,575 lbs. of steam, or 1,527,750 btu.'s per hour. With all six engines operating at full load, a total of 2,100 hp., this adds up to an hourly recovery for useful work, of 9,450 lbs. of steam or 9,166,500 btu.'s. In the treatment of sewage sludge, heat is required to break down solids before the gas will form. This heat was formerly generated in gas-fired boilers; now the dual-purpose "Vapor Phase" system cools the engines and produces heat for the sewage treatment.

The drawing illustrates the general layout of the "Vapor Phase" system. Each engine is equipped with a "Vapor Phase" waste heat exhaust boiler and each pair of engines with a "Vapor Phase" unit. To start the system, the plant water supply *A* is turned on. The automatic water make-up valve *B*, which maintains proper water level in the engine and in the "Vapor Phase" system at all times, will shut off the water when the engine jackets and the system is filled. The engines are then started. The engine circulating pump *E* is flooded by the inlet water line *D* and "Vapor Phase" unit *C*. As the water passes through the engine it picks up the heat rejected to the jackets, then passes through the exhaust boiler *F*, where it picks up the exhaust heat, then to "Vapor Phase" unit *C*, where the recovered heat flashes to steam. The *C* unit separates the steam from the water. The steam passes out line *G*, and water passes back to the engine. The steam and circulating water in this case is maintained at 5 psig or 227°F. by the steam pressure regulating valve *H*.

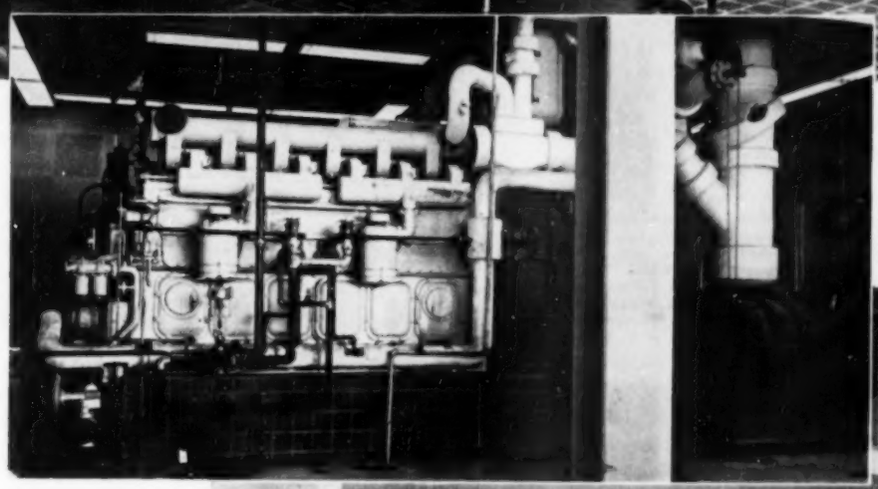
Cooling of the engine is accomplished by transferring the engine heat to the sewage sludge through de-superheater *I* to sewage sludge heater *M*, thus transferring all engine heat to the sewage sludge. In order to reduce the heat of the steam and minimize caking of the sludge on the outside of the heater, or heat exchanger tubes, a vacuum is applied by vacuum pump *J*, which reduces the temperature of the steam in the tubes to about 140°F. The condensate collects in the hot well *L*, and is returned to the "Vapor Phase" unit *C* by condensate pump *K*. Thus the engine water circuit is completely closed. Each of the four primary sludge digesters has a sludge heater or heat exchanger *M*. These heaters each have a capacity of 4,000,000 btu.'s per hour. The four heaters being much larger than required to cool the engines, allow flexibility of operation and permit taking the heaters off the line for servicing when required. The cold sludge is pumped into line *P* at the discharge of the sludge circulating pump *N*. All sludge is continuously circulated through digester *O* and heater *M* to maintain the desired digester sludge temperature. Cooling of the engine is accomplished in the "Vapor Phase" by the natural law of boiling water. While the heat exchangers used in this plant are of the new vacuum type, the "Vapor Phase" system has been used in sewage plants for more than ten years. The first "Vapor Phase" system built for sewage gas engines is still in use after more than 90,000 hours of engine operation, and the engine still has its original cylinders and pistons.

List of Equipment

"Vapor Phase"—Engineering Controls, Inc.
Engines—Enterprise Engine & Foundry Co.
Sludge Heaters—Drayer-Hanson.
Right Angle Gears—Western Gear Works.
Blowers—Sutorbilt Corp.
Governor—Woodward Governor.
Air Compressor—Quincy Compressor Co.
Clutches and Flexible Couplings—Thomas Flexible Coupling Co.
Fuel Oil Filter—Cuno Engineering Co.
Lube Oil Filter—Luber-Finer Co.
Lube Oil Cooler—Thermxchanger Co.
Intake Air Filter—Vortox Company.
Exhaust Silencer—Maxim Silencer Co.
Lube Oil Shut-off Valve—Fulton Sylphon Co.
Fuel Injection—Bendix Scintilla.



Four Enterprise 350-hp. gas engines driving four Fairbanks Morse sludge pumps through Western right angle gears. The two "Vapor Phase" units are above, between and in front of the two engines to which each is connected.



The two Enterprise 350-hp. gas engines (one behind the other) driving the Sutorbilt Blowers at the San Diego Sewage Treatment Plant.

View of office showing some of the recording flow meters.

ENSENADA,

By ALFRED A. DeCICCO

Front entrance of the Ensenada plant that was built in December, 1939, and houses six M.A.N. German diesels and one new 10-cylinder, 2,000-hp. Fairbanks-Morse diesel engine. The plant now produces 5,000 hp.

The new 10-cylinder F-M diesel (operating since February of this year). Nugent filter, Madison-Kipp lubricators, Woodward Governor, and Viking alarm system are some of the accessories used on this engine.

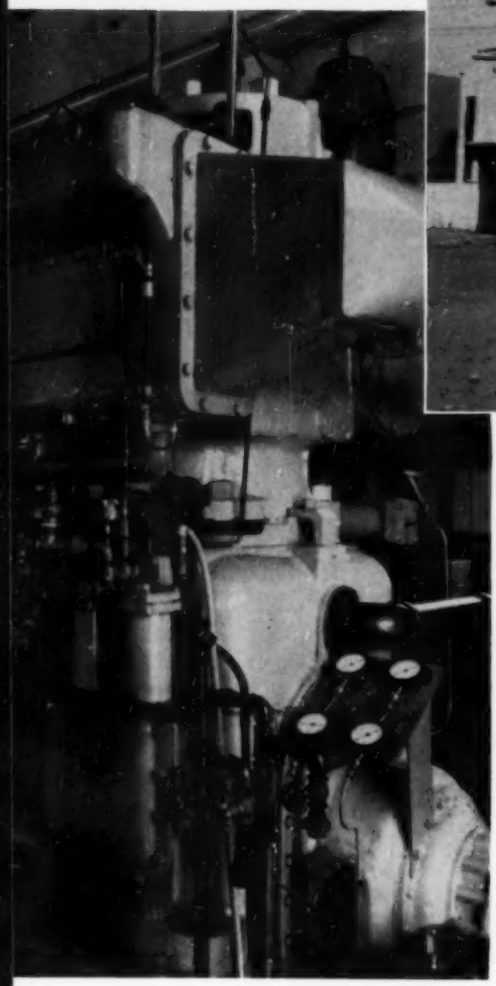
SIXTY-FIVE miles south of the United States border on the West Coast lies the picturesque town of Ensenada—a fisherman's paradise that plays host to thousands of American tourists throughout the year. A typical community of old Mexico, it offers the tourist gay, Mexican music at night and a tangible feeling of the care-free way of life as it is so well-known south of the border. Ensenada has a natural harbor that berths many small and large fishing crafts that can be seen from the northern elevated point of the highway as one drives into town. Fishing is the major industry of this community and perhaps labeled as the leading fishing section of northern Mexico.

The shops, architecture and actual mode of living is typical Mexico, but Ensenada is definitely modern and steps in the progressive direction by incorporating a most modern, up-to-date diesel plant that supplies electrical power for all Ensenada, fishing plants in and around the town, and farm areas 12 miles south of Ensenada. The plant consists of five 500-hp. M.A.N. German diesels, one 1,050-hp. M.A.N. German diesel and one new 2,000-hp., 10-cylinder Fairbanks, Morse diesel engine. The latter was put into operation in February of this year due to the increase in power demand. The plant is owned and operated by the well known Barbachano family, who have lived in this part of Mexico for many years. Manuel P. Barbachano is the president of the Border Electric Company and it is managed by his brother, Michael A. Barbachano. The company also owns one of the finest hotels between Tijuana and Ensenada.

The problem that has existed in Ensenada and its surrounding areas is most interesting and may appear complex, but this writer will try to point out briefly how the problem was solved and plans made for future development. At first Ensenada was supplied with power produced from two 50-hp. Fairbanks, Morse diesels. Due to the increasing population, the engines could not generate the sufficient amount of electrical power required by the inhabitants. To meet this demand, two new 500-hp. M.A.N. German diesel engines were installed so enough power could be produced. The 50-hp. Fairbanks, Morse diesels were used for standby units. Ensenada then had a population of 10,000 people. As the community grew and more fish packing plants opened up and farming became a close first as the leading industry in Ensenada, more electrical power had to be generated. In the Tijuana plant there were four 500-hp. M.A.N. diesels, and it was decided to lay an aluminum power line to Ensenada for relief. This did not prove satisfactory, as the damp atmosphere and salt air from the ocean deteriorated the line and made the power efficiency inadequate. Ensenada then decided to build its own new plant and began construction in December, 1939. This plant contained the two 500-hp. M.A.N. diesel engines. The community still suffering from growing pains due to the increase of fish packing industry and farm irrigation, again had to enlarge its generating capacity by installing two more 500-hp. M.A.N. diesel engines, making it four engines in the plant. As Tijuana increased in size, the plant there being too small, closed down in 1942 and found it more reasonable to purchase its power from San Diego, just across the border.

The year 1942, actually being the beginning of the war, left the Ensenada plant somewhat in a turmoil, as parts were hard to purchase, the diesels in the plant were of German make, and sending to Germany for spare parts was simply out of the question. The stock on hand had depleted and anything that was needed for the engines had to be made in the machine shop. Any idea of purchasing new, efficient engines was impossible, as most of the engine manufacturers were already in war production and could not fill orders for some time. To make matters worse, more and more American tourists entered Mexico, as the old American dollar was made and spent rather loosely in those days, and the fish packing companies were operating night and day producing food for the armed forces. Ensenada then had to resort to the idle M.A.N. diesels up in the old Tijuana plant and installed an additional 500-hp. diesel engine. This increased the plant's generating capacity to

MEXICO



2,500 horsepower—enough out-put to suffice the existing population and commercial utilization in the area. In 1946, the packing houses were still operating at an extremely high level and more help was required in the plants. Citizens from all over Mexico heard of this need of help, and the unemployment problem being what it is in Mexico, a mass migration to Ensenada was activated, all seeking work in the fish packing plants. The town's population soared to an all-time high of 22,000 inhabitants and the continuous flow of American tourists literally flooded the entire section. The last M.A.N. diesel at Tijuana, of 1,050 horsepower, was brought down and installed and immediately put into operation meeting the demand. Still parts for the engine were hard to purchase and they had to be machined at the shop.

At the end of the war and up until 1947, Ensenada, with its gentle rolling mountains covered with soft green grass and its natural peaceful environment, found itself confronted with the same problem it had during its fast-growing years. The population had been unnoticeably increasing, more business enterprises were sprouting and a huge olive plantation 23 miles northeast of town was beginning to materialize. All of which will call on the plant for their electricity in the very near future. Messrs. Manuel and Michael Barbachano, Chief Engineer Eric Herman and Electrical Engineer Pedro Perrin decided that an additional engine must be installed in order to supply this hidden growth with enough power. It would have to be an ambidextrous engine to produce enough power, one that would be highly accessible in case of sudden shutdown, and an engine for which parts could be easily purchased. The Ensenada plant, at this time, was generating 1,600 extra kilowatts for two hours a day in addition to the regular load, and failures were becoming too frequent with the old M.A.N. diesel engines. After much deliberation and foresightedness of the existing problem and the future, a 2,000-hp. 10-cylinder Fairbanks, Morse diesel engine was decided upon and purchased.

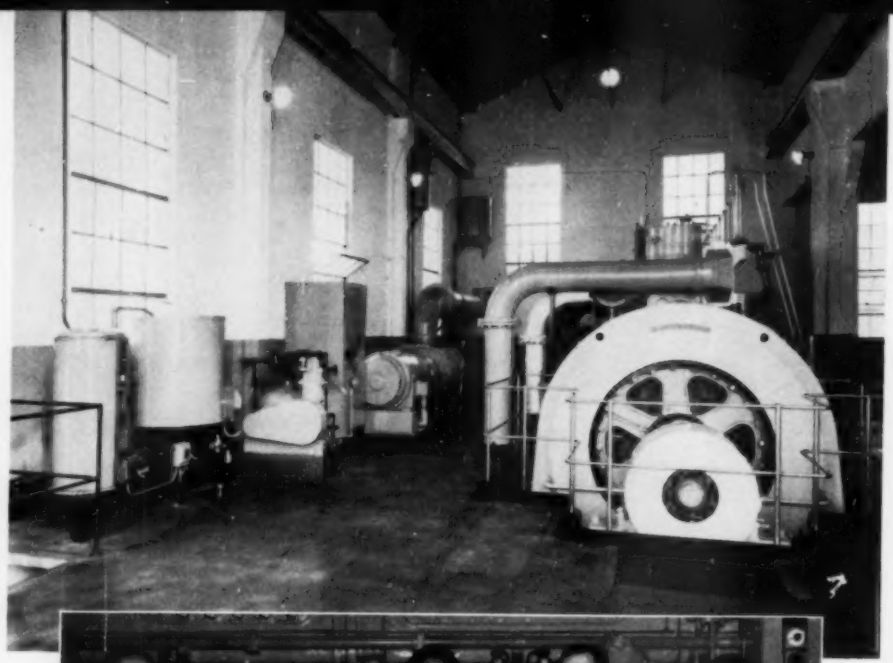
Immediate construction for the new engine began in May, 1949, and the entire installation of the engine and all accessory equipment was completed by the employees at the plant. It is rated at 2,000-hp. at 300-rpm., and is air starting. A Fairbanks-Morse, 3-phase, 60-cycle, 2,400-volt generator is directly coupled to the engine and is rated at 1,400 kw. The air receiver of this 10-cylinder F-M diesel is supplied with air from a Roots type blower of 10,000 cfm. capacity—the blower being independently driven by a 125-hp. electric motor.

The fuel supply system includes the fuel storage tank fuel filter, built-in fuel supply pump, supply reservoir and the connecting pipes. It was advisable to use a preheater for the fuel system in this type of installation. The fuel is taken directly from the service tank and is transferred from the tank to the reservoir. A pressure gauge mounted on top of this supply reservoir registers from five to eight pounds pressure, and an overflow from the engine to the tank is provided. The fuel is directly injected into each cylinder and the properly timed injection is accomplished by meshing the members of the gear train and adjusting the camshaft with respect to the camgear. This operation was carefully watched by the chief engineer in order to receive the utmost efficiency from the fuel system.

The lubrication system in the Fairbanks, Morse engine is quite unique in that it is of the wet sump type. With this system one built-in gear type lubricating oil pump is used. This pump draws the oil from the lower base suction header. The pump delivers oil under pressure through the oil cooler and the oil strainer, from which it is piped to the main oil distributing header in the lower base. By means of branches from this header to each main bearing, and through drilled passages in the crankshaft, connecting rods, and piston pins, oil is delivered to the piston crown. The oil is returned to the lower base through telescopic tubes and individual thermometer wells. These thermometers register a temperature of about 170 to 175 degrees F.

A branch from the main header supplies oil to the cams and to the force feed lubricator. The lubricator supplies oil to the pistons and cylinder walls, and several parts of the built-in auxiliaries. The excess oil from the lubricator and overflow from the camshaft bearings supplies enough oil so that the injector and air start cams operate in a bath of oil. The excess oil from the cylinder walls, being somewhat contaminated with carbon, is removed by means of scraper rings. The oil is collected in a header whence it flows and is pumped from a connection at the end of the engine to a cylinder drain oil tank. A transfer pump is used to convey the oil from the tank to the filter.

Cooling of the jacket water and lubrication oil is accomplished by means of an evaporative cooler which contains coils for both jacket water and lube oil. The raw water supply is maintained in the base of the cooler and is circulated over the coils by a built-in circulating pump. A blower located on top of the cooler draws a supply of air through the coils in opposite direction to the raw water and the heat of the jacket water and lube oil is ab-



View showing the directly driven F-M generator that is rated at 1,400 kw. and showing the Honan Crane filter, Gardner-Denver air compressor and Roots-Connersville blower which is rated at 10,000 cf/m.

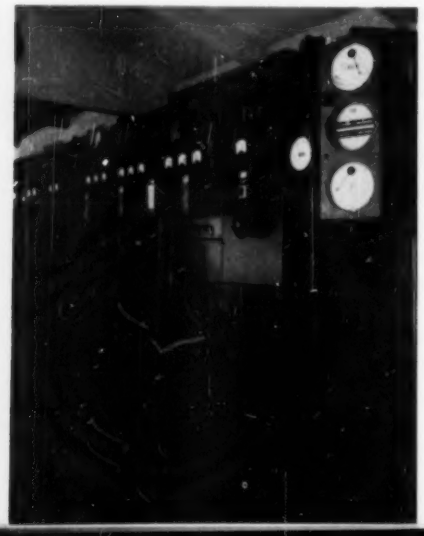
sorbed by the air through direct transfer and evaporation of water on the coil surface. The intake and discharge air dampers are automatically controlled to maintain desired temperatures.

Much credit is due to this diesel plant in Ensenada that produced in 1949 an annual output of 6,899,850 kwh. Enlarged from a 100-hp. diesel generating plant to over 5,000 hp. and staggered, but recovered from severe problems confronted in the past 15 years, and is now equipped to produce power for Guadalupe, Olivares, Mexicanas and further south of Ensenada. It is through this plant that Ensenada has been able to offer its citizens the many services of this outstanding community and to continue to be a friendly host to their American neighbors who appreciated the privilege of visiting Mexico and enjoying the atmosphere of yesteryear. The Barbachano family has every right to be proud of their contribution to the community and of the progress it has made in the past.

List of Equipment

Engines—One 2,000-hp. Fairbanks, Morse; six M.A.N. diesels.
Generators—One Fairbanks, Morse; two G.E.; three AEG.
Governor—Woodward Governor Co.
Air Compressor—Gardner-Denver.
Fuel Oil Filter—Wm. Nugent.
Fuel Oil—Standard of California.
Lube Oil—The Texas Company.
Lube Oil Strainer—Purolator Products, Inc.
Lube Oil Reclaimer—Youngstown Miller.
Evaporative Cooler—Fairbanks, Morse.
Lube Oil Gauges—D.P.S. and Ashcroft.
Intake Air Filter—Air-Maze.
Exhaust Silencer—Maxim Silencer Co.
Exhaust Pyrometer—Brown Instrument Co.
Lube Oil Pressure Alarm—Viking Instrument Co.
Flexible Connections—Chicago Metal Hose Co.
Switchboard—Mullenbach Mfg. Co.
Switchboard Instruments—General Electric.
Lubricator—Madison-Kipp.
Fuel Oil Centrifuge—Sharples.
Air Blower—Roots-Connersville.
Lube Oil Filter—Honan Crane.

Some of the Mexican government officials present at the inauguration of the new F-M engine. From left to right: Ernesto Zenteno, Mayor of Ensenada! Manuel P. Barbachano, President of Border Electric Co.; Alfonso Garcia Gonzalez, Governor of Territory; Enrique M. Gonzalez, Sub-secretary of Communications; Alejandro Paez Urquida, Chief of Electricity.



View showing five 500-hp. M.A.N. German diesels and one 1,050-hp. M.A.N. diesel in the rear. These engines were carrying entire load prior to the installation of the new Fairbanks-Morse diesel.

FARMER REALLY MAKES THIS DIESEL TRACTOR WORK

By WILL H. FULLERTON

Mrs. Daisy Everman, R. R. 1, Dansville, N. Y., really keeps her Caterpillar diesel tractor busy. In the top illustration the tractor is pulling a manure spreader; in the middle illustration, the tractor with belt attachment is driving equipment in the barn; in the bottom illustration, the tractor is pulling a Jumbo carrot digger.

WEYERHAEUSER'S SNOQUALMIE FALLS TREE FARM DIESELIZES 100%

By CHARLES F. A. MANN

OUTSIDE of the industry itself, relatively few understand the far-reaching revolution in the entire business of logging, lumbering and the business of growing and harvesting trees.

Yet the big revolution in the whole chain of enterprise necessary to harvest trees and make consumer goods, that has taken place in the past 25 years has escaped attention of a kind it deserves. Briefly, American forest industries have undergone a drastic change from a cut and get-out semi-permanent industry, whose very machinery, capital investment and manpower were migratory by instinct, to a rooted, permanent and highly integrated industry based on perpetual harvest of trees from fixed land areas, that utilizes every cubic inch of wood from a tree, down to the last piece of bark. The old sawmill with its waste burner and equipment that cut only the high-value products out of a log, is a dying institution. In fact its funeral will probably occur within the next two years. Now huge integrated companies plant, grow and harvest trees systemically, like a crop of corn, tomatoes or peas. Except, of course, the one year harvest is stretched into a one *Century* harvest. Every particle is used for something of value. Heavier and heavier investment in equipment and machinery and more scientific methods based on research, engineering and imagination, go into the enterprise each year. Today, the old time logging railroad and steam donky engine are almost dead ducks. Once they were the foundation of getting trees converted to logs and down to the sawmill or paper mill.

In the past 15 years a whole new concept of the industry has converted loggers into Tree Farmers and converted a rail and steam type of operation to strictly a mobile, highway-type with everything mounted on skids, flatbed trailers, multiple wide-tired steel wheels, caterpillar tractor treads or huge rubber tires.

The slow, costly advance of the logger into the woods on rails and by means of donkey engines with miles of spinning cables, is gone. Today's logger may work on a small tract of ripe timber in the southwest corner of section 45 one season, and in another tract of timber in the east part of section 76, 25 miles away, the next season. Its all done with a roadway network and mobile equipment that will negotiate 15% grades safely, instead of long, winding railroad grades of from 1 to 5%. One of the model operators in the U. S. timber business is the great Weyerhaeuser organization of the Pacific Northwest, whose roots began in the Black Forest of Germany a century and a half ago.

One of the 14 giant rail-car width special model 548 Kenworth logging trucks with a full railroad logging car load of fir logs, going down the main 3-lane hard surface highway in Snoqualmie Falls Tree Farm, to the mill. Each of these giant units has a 200-hp. Cummins diesel.

spread across the Minnesota-Wisconsin country and at the turn of the century, to bail the bankrupt Northern Pacific Railroad out, into Oregon-Washington and Idaho, via purchase of huge blocks of their timber grant to give the N. P. cash and freight traffic in one transaction. Once a timberland operator only, through the years it has changed into a sprawling, fully integrated timber growing as well as utilization company, that actually grows annually more cubic feet of new wood on its lands than it cuts down. It is the dominant factor in lumber, dissolving and paper pulp and wood specialties on the West coast.

Its operations are divided into great groupings around established Tree Farms, whose private holdings touch or are intermingled with great stands of State and Federal timber, all managed on a crop basis, so that timber supply will be constant forever. Originally a partially owned operation, known as Snoqualmie Falls Lumber Company, and now an operating branch, it is one of the ten huge divisions of the Company devoted to harvesting and processing trees. The Snoqualmie Falls operation was originally set up as a modern steam railroad and steam donkey engine operation, with about 150 miles of logging railroad radiating out from the mill. While tucked close to the foothills of the Cascade Range, from 40 to 60 miles due East of Seattle, near the west entrance of Snoqualmie Pass, it lies at an amazingly low alti-

Part of Snoqualmie Falls Tree Farm of Weyerhaeuser Timber Co. Totals about 160,000 acres of Weyerhaeuser Timber Co. timberland, plus double that amount of state, federal and granted timber intermingled or tributary to this operation. Cascade range in background. Logging Highway network stretches through it.

tude, being but 400 feet above sea level at the mill, working by easy slopes up to 1,500 feet and in some places cutting is being done above 3,500 feet. Twenty years ago its key men felt that by 1960 the most of the timber would be gone and so would the lifeblood payroll of that area. Today, in 1950 after scientific forest practices began to analyze the picture as not today's cut of trees, but a century's cropland of growing timber, actually the the entire Snoqualmie Tree Farm still has 40% of its original old growth trees standing in the woods! Annual cutting has been cut back to what the total acreage will grow as a crop. Every bit of waste is used there or down at the Everett lumber and pulp mills. Young seedlings grow faster than the old trees are cut out. So it will be 100 years from now, with fire protection and proper forestry methods. The 160,000 acres of Company land, with double that acreage of accessible State and Federal lands that can be tributary to the Snoqualmie operation, bulwark the timber supply and make long-range of heavy capital investment a sound proposition, to match the easier tax burden that must be borne by private timber owners, but lessened if they set up registered tree farms and go on a crop harvest tax basis instead of a land tax basis that would bankrupt private owners within a few years.

Snoqualmie Falls, in the past five years, has emerged as one of the West's model new-type highway logging operations. The old rail and steam program has been torn up and scrapped, and it is now 100% dieselized, except the few fast fire trucks that keep the timber green in the fire season. To understand what this means, one has to visualize a 150-mile railroad torn up and scrapped; a whole system of logging scrapped, and 200 miles of costly private logging highway threaded through all parts of the tree farm so little tracts of ripe timber can be harvested in the winter at a low altitude when snow covers the higher hills, and big, fast removals of tall trees on mountain peaks economically done when snow vanishes in the short summer season. Some of the highway construction cost $10,000 per mile for a three-lane logging roadway with a base of crushed rock.

Now 100% dieselized, some 42 pieces of diesel equipment, single units of which cost up to $30,000 each, the Snoqualmie Falls operation is flexibly and economically set up to run with no major engineering changes for the next century. Basically, the roster of diesel equipment includes the following fundamentals at Snoqualmie Falls farm:

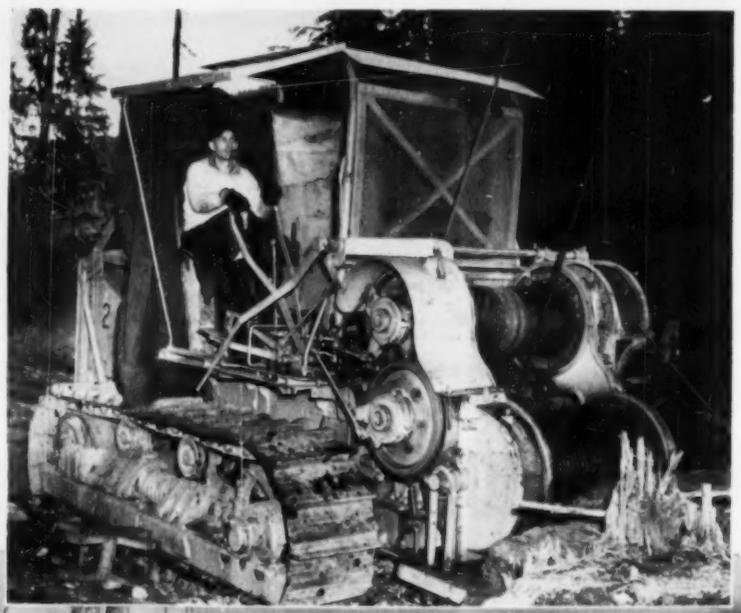
(1) A fleet of trucks to transport the harvested logs out of the woods to the millpond. (2) Road building tractors and dozers. (3) Road maintaining scrapers. (4) Logging tractors. (5) Log yarders to haul fallen trees in sections to the loading docks. (6) Shovel type loaders and dirt movers to load logs from the end of the yarder haulways, and move dirt and rock that the dozers cannot handle.

At Snoqualmie the entire six categories of equipment are 100% diesel! In actual operation, the well housed, well fed logger and his fellow workers go into the woods and saw down selected, marked trees, with power driven chain saws; buck them up into sections small enough to fit a truck with power saws, first removing dead sections, limbs and other waste. Either a yarder, a modern diesel driven version of the donkey engine, with hundreds of feet of cable on its spinning drums, each operated with fast air clutches and brakes, or a diesel tractor, brings them to a cold deck pile, where diesel loaders put them on a fleet of giant diesel Kenworth trucks and they are swiftly hauled downhill to the millpond. The big trucks, operating over private logging highways, have the green light on traffic, and make from 3 to 5 round trips per day, depending on the distance to be hauled, and the mileage of bad or steep spur road to traverse before hitting the main truck expressway. Coming back their semi-trailers are loaded piggy back on the main truck. A diesel unloader rig finally empties the railroad logging car-size load with a terrific splash into the log pond.

Gone are the steam donkeys, the horses, the steam tower skidders and the steam logging engines. Today's diesel equipment is faster, saves fuel and reduces fire hazards to a quarter of what it was in the "good old days." It took $5,000,000 to revamp and modernize Snoqualmie Falls Tree Farm, and it is an investment that will pay dividends for a whole century to come. The shorter, steeper logging highway network cuts time from the woods to the mill, and is so flexible as to permit taking truckloads of 10 to 15,000 feet of logs one at a time from every part of the whole vast Tree Farm of nearly 250 square miles, including state lands within the boundaries of private company ownership, in one single operating day, if the need arises from fire or operating or forest practice requirements!

Actually, however, such a spread is not used in regular practice, but it is the most vivid example of how truck logging spreads the working circle out so that a Tree Farmer can harvest his maturing crop like pea or corn or tomato harvesting operation, and with even greater ease. Maintenance of equipment is done in slack or winter seasons at a big shop near the sawmill at Snoqualmie Falls. Road work is done whenever they are dry or on shut-down days. The crews live permanently and have variety enough of work to do to keep going the year round. The diesel Tree Farm at Snoqualmie sets the pace for the entire logging industry.

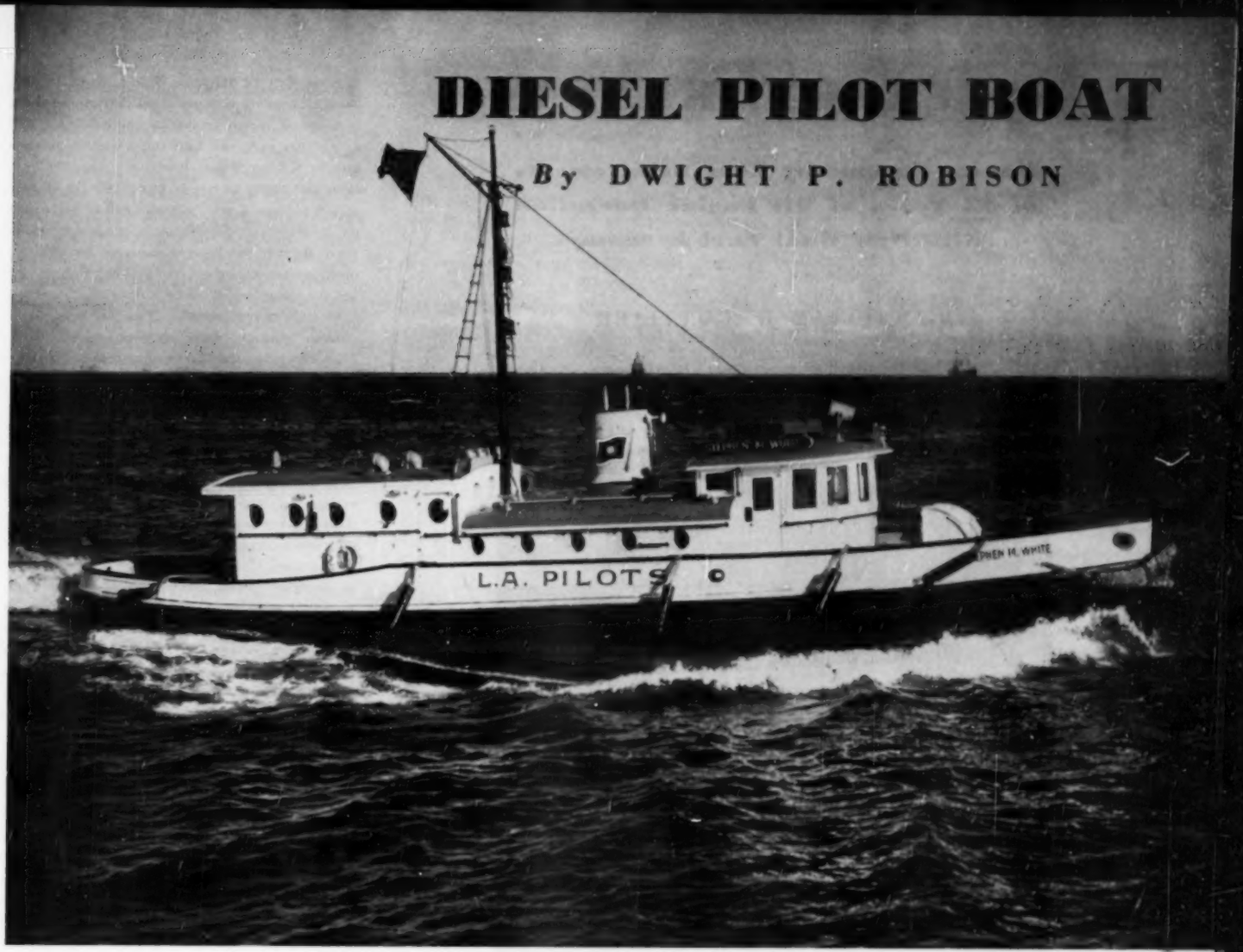
Cletrac tractor with Careo triple drums and 113-hp. Hercules diesel.



Dumping logs at the end of the run at millpond.

DIESEL PILOT BOAT

By DWIGHT P. ROBISON



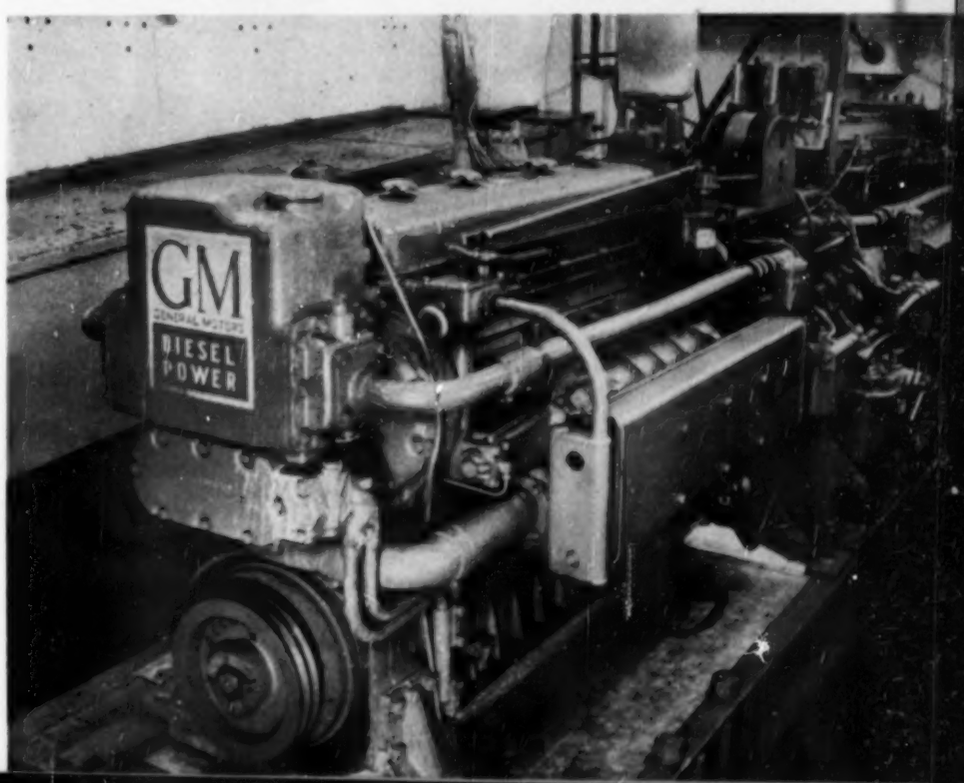
THE Port of Los Angeles Authority has provided its pilot boat, the *Stephen M. White*, with a new General Motors Series 71 tandem twin diesel engine. This new engine replaces the old diesel engine installed in the *Stephen M. White* some eighteen years ago. A most important factor of this installation is that the old motor was approximately three times heavier in weight than the present diesel engine, which, with its 360 shaft horsepower, has increased the cruising speed of the pilot boat some 10 per cent, and has reduced the necessary time to make sternway from full-speed ahead to less than half the time required from the old engine.

The Crofton Diesel Engine Company, Inc., was awarded this contract and installed the engine complete with heat exchangers, water cooled exhaust manifold, jacket water circulating pumps and thermostats, raw water pumps, air intake silencers, lubricating oil coolers, filters, oil circulating pumps, reduction gear, etc. An alarm system was also installed, which is activated by low oil pressure or high water temperature.

The *Stephen M. White* has proved extremely efficient, economical and satisfactory as regards to performance. With the new G. M. diesel engine, she is expected to give many more years of service.

Los Angeles pilot boat *Stephen M. White* recently reconditioned and repowered with a net 10 per cent increase in speed.

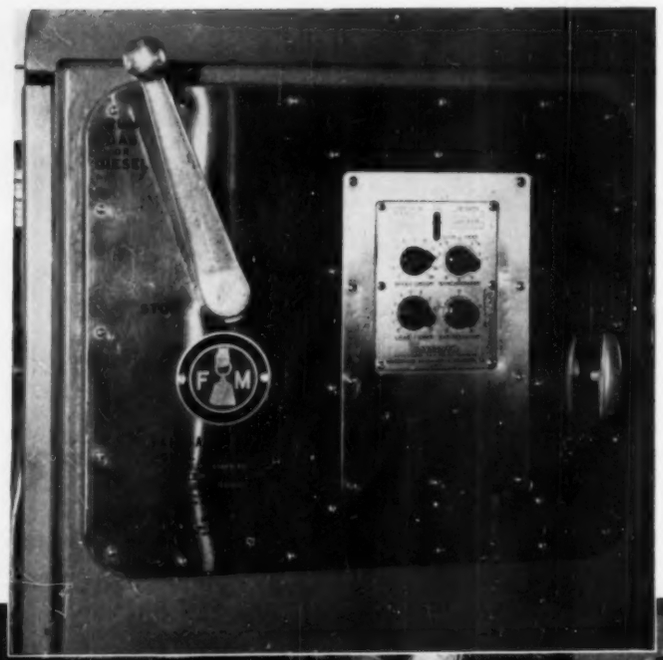
The General Motors Series 71 tandem twin diesel engine installed in the *Stephen M. White* by the Crofton Diesel Engine Co.

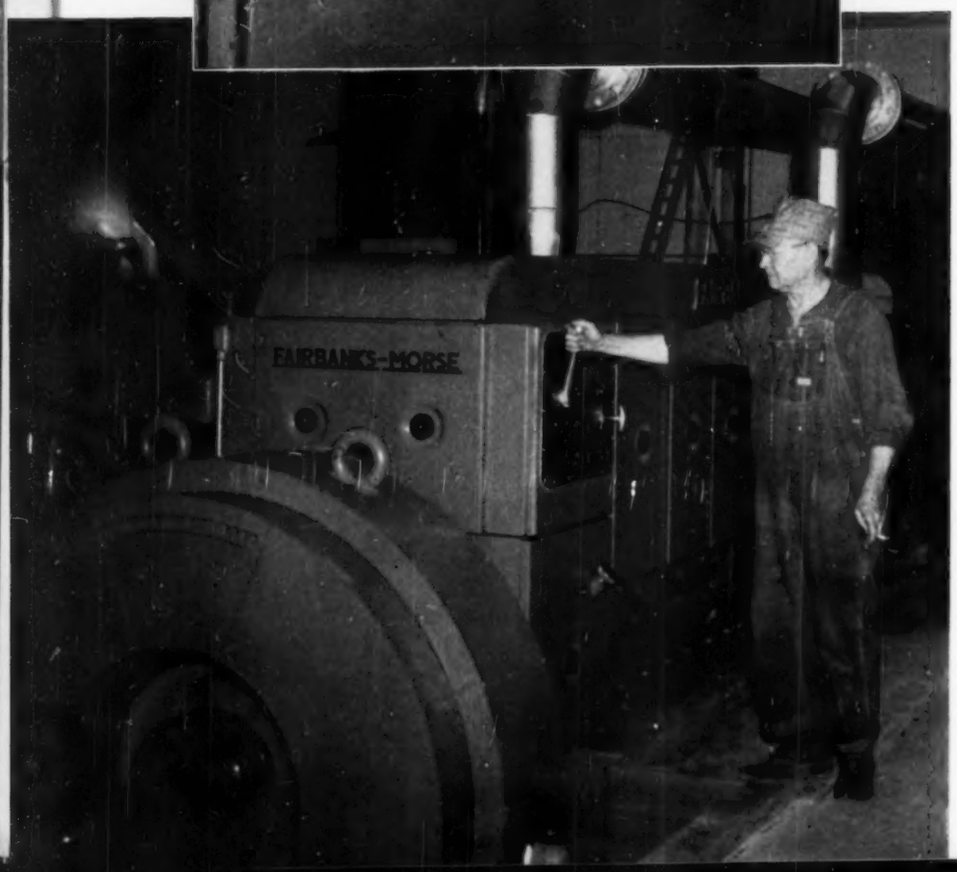


STOCKTON, KANSAS

Kansas Community Tops Achievements of 42 Years of Oil Engine Operation with New Dual Fuel Economy

By WILLIAM H. GOTTLIEB





IF the City of Stockton, Kansas, chose to look back over its 42 years of oil engine operation, it could cite some notable accomplishments: (1) diesels now in service have run a total of nearly a quarter million engine hours; (2) the plant has been shut down for engine repair only an average of 6½ minutes a year; (3) all engines have original bearings and there hasn't been a stuck ring in ten years; (4) the Light department has shown a profit every year, more than $140,000.00 in the last ten. But this Western Kansas community of 2,000 likes to look ahead and the big news at the modern Stockton power plant is a new 520 hp. Fairbanks-Morse dual-fuel engine that has cut fuel costs to 3.1 mills per kwh. despite an operating-engine load factor of less than 60 per cent.

Stockton has done its share of pioneering. Back in 1908, when most other municipal power plants were putting in steam, Stockton put its money on oil-burning internal-combustion engines and installed a Hornsby-Ackroyd 100-hp. engine, a design which actually antedated the diesel as a successful self-ignition prime mover in actual service in America. Then followed a succession of six Fairbanks-Morse diesels: a 200 hp. in 1922, a 120 hp in 1926, a 360 hp. in 1930, a 300 hp. in 1935, a 450 hp. in 1947, and the 520 hp. in 1949. All but the old 100 hp. and 200 hp. units are still on hand. Even the 120 hp. engine, in its 23rd year, contributed 1,233 hours of service.

The most impressive service record in the plant is held by the 300 hp. diesel which has run more than 103,000 hours since its installation in 1935. This means that in 13½ years, the unit ran 87 percent of the time. The record of durability and dependability becomes even more impressive as we narrow our sights to the years of peak performance. In the 12 years, 1936 to 1947 inclusive, the engine ran 98,377 hours out of a possible 105,120, or 93.5 percent of the time. In the nine years, 1938 to 1946 inclusive, the diesel ran 76,292 hours out of a possible 78,840, or 96.7 percent of the time. In the peak year 1944, the durable diesel was in service 8,718 hours of a possible 8,760, actually 99.5 percent of the time. Dependable performance year after year on the most exacting schedules is important, but diesels earn their keep by efficient and economical conversion of fuel into electrical energy. The Stockton prime movers have been consistently efficient though working at little better than half load. In the last ten years for which figures are available at this writing, the diesels produced 13,667,599 kwh. while consuming 1,087,382 gallons of fuel, an average of 12.56 kwh. per gallon. It is worth noting that the figure went as high as 12.77 but never dropped below 12.27. The table gives yearly figures for the 10-year period on kwh. generated, fuel oil consumed, lubricating oil consumed, kwh. per gallon of fuel, and engine hours.

Put a dollar sign in front of this efficiency and it is plain to see why Stockton kept buying diesels through the years. In the 10-year period we have been discussing, plant operating costs totaled $159,848.40. Total operating expenses of the light department, including plant, distribution system, administration, and fixed charges, came to $232,782.57. Receipts for the ten years added up to $573,092.65, leaving a net operating profit of

$140,310.08. Part of these profits were ploughed back into purchase of new equipment and other system improvements. Part was transferred to other municipal funds for such projects as street paving, fire equipment, water department wells and mains, parking lot, auditorium, and sewers. To insure continuation of these profits and community benefits at a high level in an era of high operating costs, Stockton's city manager, O. M. Goodrich, has taken every means to improve plant efficiency and cut production cost. The most important expedient was the choice of a dual-fuel engine to meet expanding power requirements.

The engine chosen, the Fairbanks-Morse, is a two-cycle, heavy-duty unit with built-in scavenging air blower. It has eight cylinders, 8½-inch bore and 11½-inch stroke, and produces its rated bhp. at 514 rpm. Other features of this design are removable cylinder liners, oil-cooled pistons, full pressure lubrication of all bearings, and interchangeability of crank pin bearings and main bearings as well as upper and lower halves of the bearing shells. Interest focuses, of course, on the fuel system, for this engine can operate on gas with a small charge of oil as a pilot fuel. It can run, too, as a full diesel, or on any combination of the two fuels. Governor controls are such that the engine switches automatically to oil if the gas supply fails and back to gas when it resumes its flow. This permits safe utilization of uncertain gas supplies and also makes it possible to obtain better rates for gas. The dual-fuel is a high-compression engine with higher efficiency than is possible for the low-compression gas engine.

Gas averaging 988 btu. reaches the plant at 60 lbs. pressure and is reduced to 20 lbs. in a regulator before it passes through a meter and goes to the engine system. The gas passes through an admission valve, controlled by governor linkage, into a header, then through a cam-operated valve at each cylinder. The lift of the cylinder valves is constant and the only factor controlling the amount of gas entering the cylinders is the pressure in the header. This pressure is varied to meet varying load conditions through governor control of the valve admitting gas to the header. The pilot oil charge is constant and is set at about 8 percent of normal full-load diesel requirements. In designing a dual-fuel engine, one difficult problem has been to produce a fuel injection pump that would function efficiently with the relatively large quantities of oil demanded for full diesel operation and the small pilot charge for dual-fuel. Fairbanks-Morse engineers have solved the problem by designing a double-plunger injection pump with a large governor-controlled variable-output plunger for diesel service and a small fixed-output plunger for pilot oil. The big plunger also comes into use in the event of partial failure of gas pressure or in any situation requiring a larger charge of oil than the fixed pilot charge. This provides efficient injection of oil under any operating situation. Also, since both plungers feed the same injection nozzle, the nozzle is not left idle for long periods

Here is what dual-fuel operation means to Stockton: The new engine started burning gas on September 22, 1949, and had been running 140 hours when this writer visited the plant. In that time it consumed 464,688 cf. of gas and 345 gallons of fuel oil while generating 30,010 kwh. This amounts to 15.4 cf. of gas and .0116 gallons of oil per kwh. With gas at 18.5 cents per mcf (the rate earned by the current operating schedule) and oil at 7.75 cents a gallon, the cost per kwh. is less than 2.2 mills for gas and 0.9 mill for oil, a total fuel cost of 3.1 mills. This compares with a straight diesel fuel cost of 6.1 mills per kwh., a solid 3 mill saving. Needless to say, Mr. Goodrich and Chief Engineer Floyd H. Lightfoot plan to run the new engine as much as possible. Even though it would be possible to achieve a better load factor with some of the older engines, dual-fuel economy dictates continuous operation of the new unit. Consequently it is planned to keep the engine on a 24-hour schedule from January through December, with only an occasional short stop for servicing.

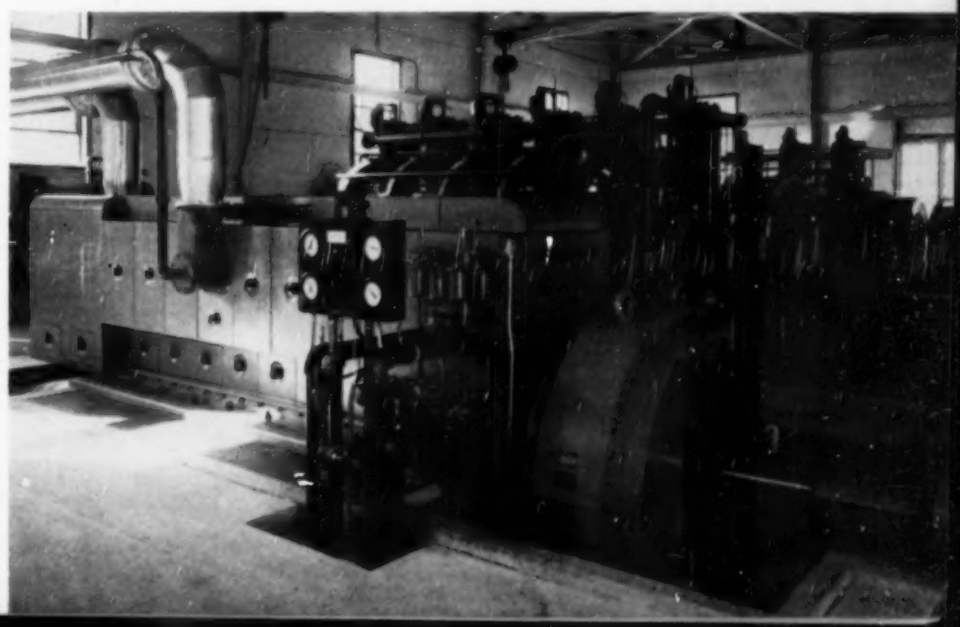
Projected against this operating schedule, the savings per kwh. grow to well over $5,000.00 a year. Recent reports from Stockton indicate that everything is going according to plan. It is expected, further, that the growing load will improve the load factor, give better engine efficiency, reduce the percentage of load carried by the constant pilot oil charge, and bring even greater savings. Lubricating oil for the new engine is by-passed continuously through a duplex cellulose-packed filter and is cleaned also by edge-type filters on the engines. A shell-and-tube oil cooler is included in the lube system. Also there is a motor-driven auxiliary lube pump for use in starting and shutting down.

Two 4-inch, 600 gpm. motor-driven centrifugal pumps handle cooling water for the new engine. One puts soft water through the engine jackets and a shell-and-tube heat exchanger. The other circulates raw water through the exchanger and to an atmospheric-type cooling tower. A thermostatic regulator maintains jacket temperature by by-passing raw water around the exchanger. Jacket water makeup is treated in a zeolite-type softener. Scavenging air is drawn through an oil-bath filter outside the plant. Exhaust gases vent through a vertical silencer, also outside the building. Starting air for both old and new engines is provided by a motor-driven compressor. A compact gauge board mounted beside the engine holds a multipoint exhaust pyrometer and pressure gauges on fuel oil, lube oil, jacket water and scavenging air. There are alarms on all but the air.

Stockton believes in holding to essentials. It is evident that there was no stinting in power plant equipment, but city officials could see no reason to house their engines in an elaborate brick and stone edifice. Consequently, when the plant outgrew its aged brick building, a prefabricated steel structure was purchased to house the 360, 450 and 520 hp. engines. This solid 60x80-foot building, lined with Cellotex, cost but $8,500.00, yet provides a well-lighted, modern, convenient power house with plenty of room for expansion. The plant is operated by Chief Engineer Lightfoot under the general supervision of City Manager Goodrich. Mayor I. D. Wright and Commissioners Clark B. Simpson and C. H. Ostmeyer confer on major policy matters. For more than four decades, the Stockton municipal power plant has provided citizens of the community the multiple blessings of good service, moderate rates, and substantial profits. The advent of modern dual-fuel prime mover promises to continue the service record and augment the financial benefits.

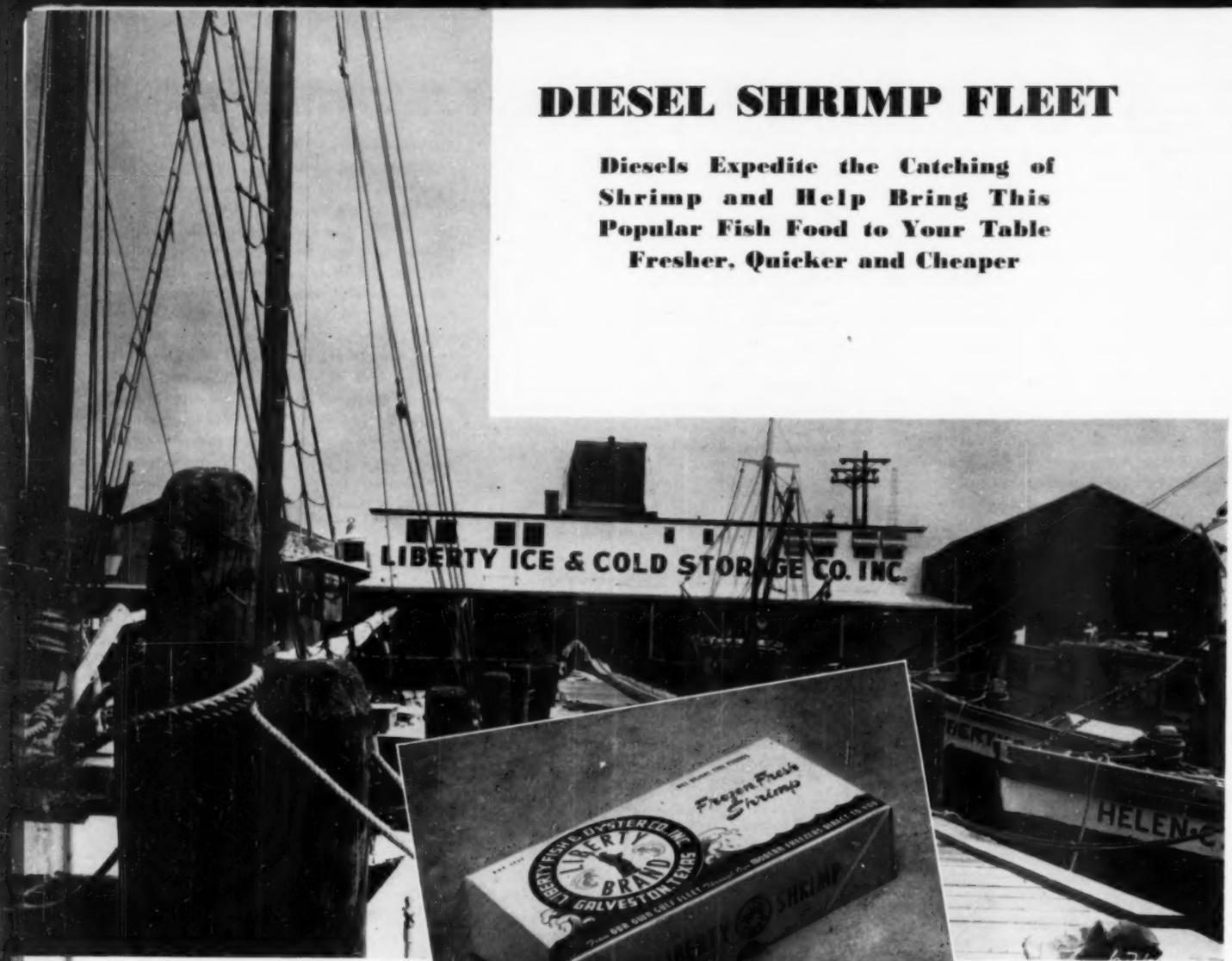
Equipment List

Air Filters—Continental Air Filters, Inc.; American Air Filter Co.
Alternators—Fairbanks-Morse & Co.
Cooling Tower—Marley.
Cooling Water Pumps—Fairbanks-Morse & Co.
Engines—On 520 hp. dual-fuel; one 450 hp.; one 360 hp.; one 300 hp.; one 120 hp. Fairbanks-Morse & Co.
Exhaust Pyrometers—Alnor, Illinois Testing.
Exhaust Silencer—Maxim Silencer Co.
Fuel Oil Filters—Purolator.
Fuel Oil Meter—Pittsburgh Equitable Meter Co.
Fuel Storage—One 10,000-gal., two 12,000-gal.
Gas Meter—American Meter Co.
Gas Pressure Regulator—American Meter Co.
Governors—Woodward Governor Co.
Heat Exchanger—Ross Heater & Mfg. Co.
Lube Filters—Fairbanks-Morse & Co., Cuno.
Lubricating Oil—Sinclair Refining Co.
Oil Cooler—Ross Heater & Mfg. Co.
Piston Rings—Double-Seal; C. Lee Cook.
Starting Air Compressor—Fairbanks-Morse & Co.
Switchboard—General Electric Co.
Thermostatic Regulator—Powers.



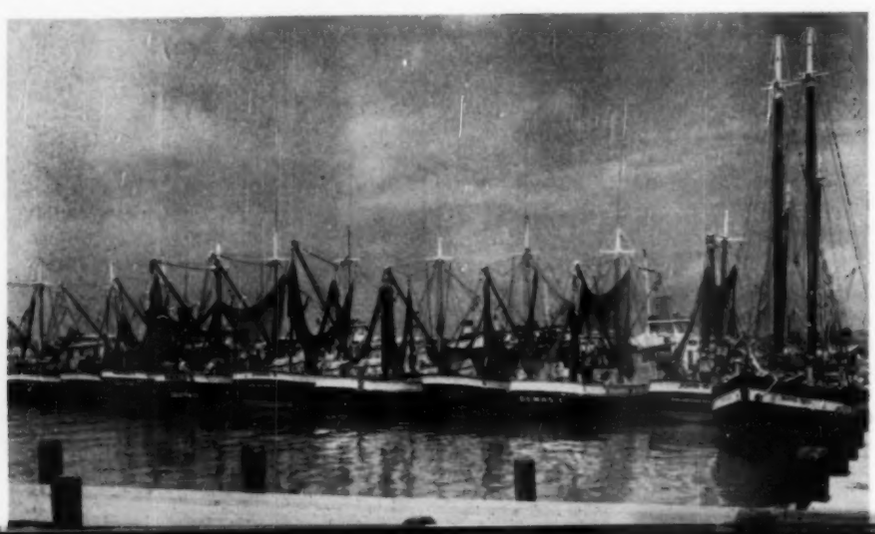
DIESEL SHRIMP FLEET

Diesels Expedite the Catching of Shrimp and Help Bring This Popular Fish Food to Your Table Fresher, Quicker and Cheaper



Garrus H. Booras, secretary of the Liberty Fish and Oyster Co., Inc., Galveston, Texas, is the driving force behind this profitable fishing operation.

One of the most successful applications of the use of diesel engines in the catching of fish is the almost complete Caterpillar dieselization of the Liberty Fish and Oyster Company's fleet operating out of Galveston, Tex.



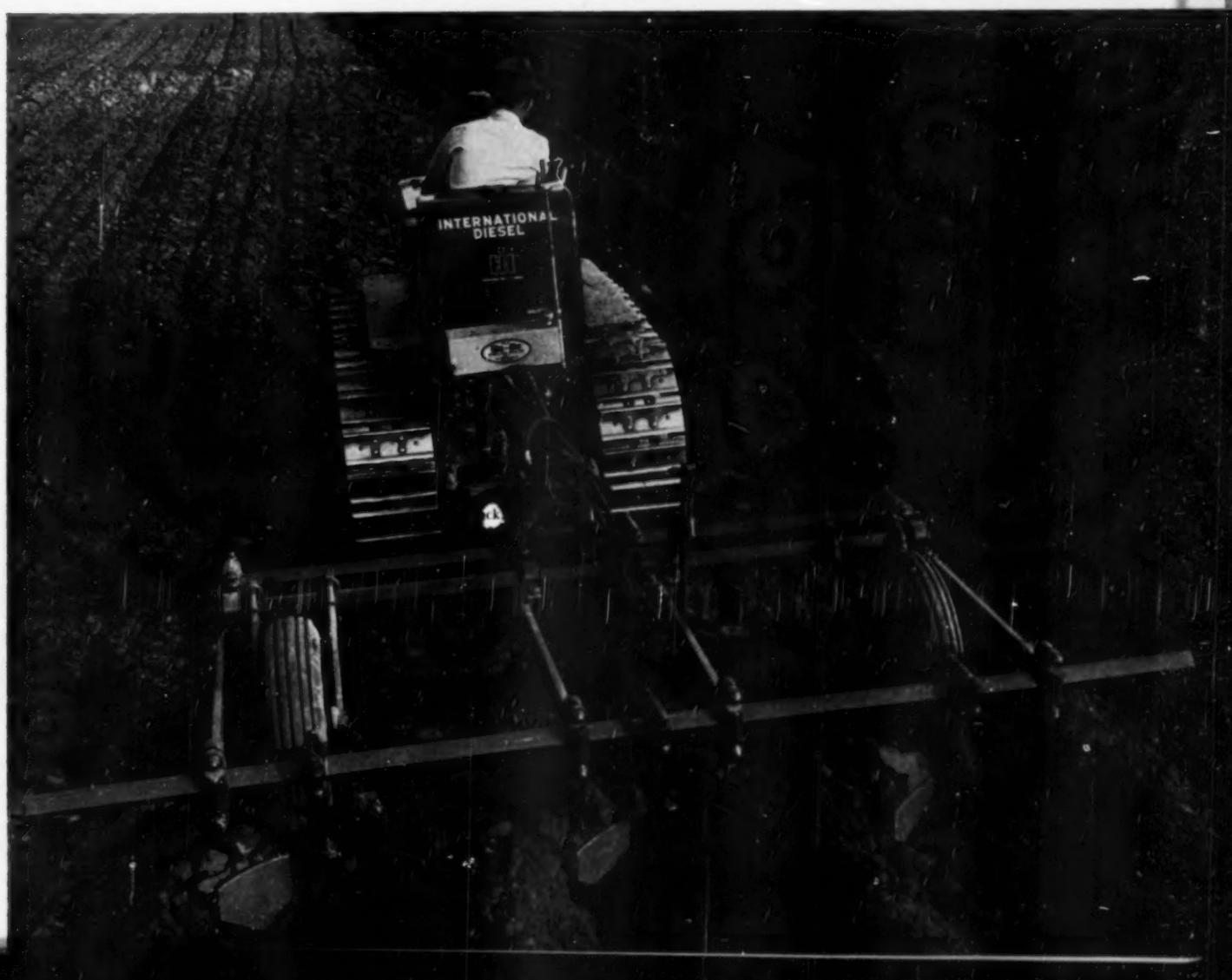
DIESEL SPEED THE "AMERICAN WAY"

University of California Farm Machinery Conference Points to Rapid Mechanization of All Crops to Iron Out Twin Humps in Annual Hand Labor Graph While Giving Skilled Labor Steady Year-round Work at High Wages

By F. HAL HIGGINS

THAT diesel farm power revolution that started back in the bottom of the depression is gaining momentum and solving labor, social and political problems as well as California's agricultural power. So the writer found on his visit to the nineteenth annual Farm Machinery Conference of the University of California at Davis early this year. These facts were highlighted by the speakers from agricultural engineering staff, farm and a diesel dealership: 1. Mechanization of the California crops is making more farm jobs instead of less; 2. "Stoop" labor is being replaced with skilled farm machine operators at higher wages; 3. Migrant labor is replaced by family workers who work the year round when diesel-powered machines take over; 4. Farm labor anchored on the ranch permanently gives the workers' children schooling and eliminates child labor from the fields; 5. Better farming comes with mechanization instead of hand labor, as management adds live stock and more crops to anchor the skilled labor on the farm by year-round employment; 6. Better housing for the labor comes with skilled instead of stoop labor; 7. The social and political problems of communities that have been overrun by an annual or semi-annual influx of hand laborers who run out of funds between work seasons are eliminated.

Dean K. A. Ryerson, of the College of Agriculture, opened the session with a challenge to the visiting farm machinery industry in pointing out that there are social responsibilities that go with mechanization as it takes place as rapidly and efficiently as this trend in California today. Prof. H. B. Walker, former head of the Agricultural Engineering Division of the University, who has made such a reputation in the farm mechanization field that he is frequently called to Hawaii, New Zealand and Australia to advise governments in this field, then followed to set up the diesel targets for today and tomorrow in the farm field. Walker took the official figures of the State of California Department of Employment on all California crops to show how the grain and rice crops have already been mechanized until they have no seasonal labor humps to disturb the social surface of the state. Both are so completely dieselized that IH, A-C, and Oliver and Cat crawler tractors are the



No. 1 pieces of equipment on every ranch. Yet both crops in early California farming once had as bad twin humps of planting and harvest labor as the un-mechanized crops still left in the list.

Picking out alfalfa, apples, apricots, cotton, small grain, grapes, lemons, oranges, peaches, pears, plums, prunes, potatoes, rice and tomatoes, Walker compared the "man weeks per unit of production" to show prunes and cotton standing up as the highest labor requirements. He then divided the crops into three groups: 1. Field crops; 2. Vegetable crops; 3. Fruit and nut crops.

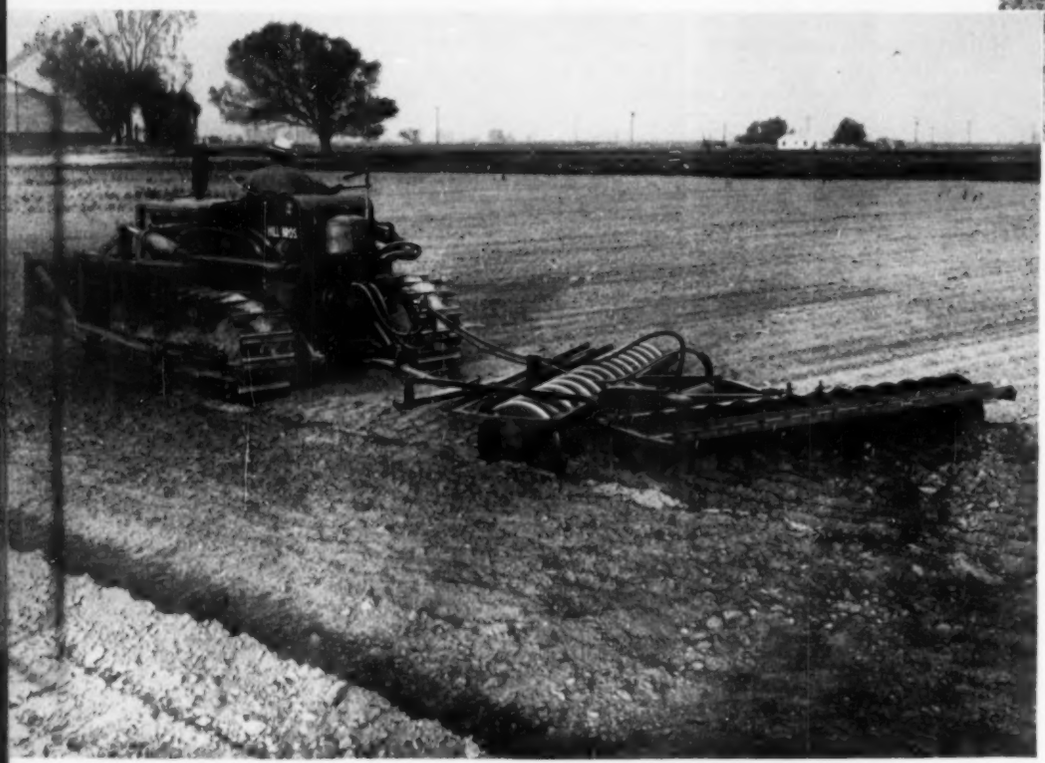
In 1948 (year in which latest statistics were available), said Walker, these crops in California required 6,061,660 man weeks of labor. Nearly half, or 45 percent, was for the fruit and nut crops; 23 percent for vegetable crops, and 32 percent for field crops. If these were "straight line" requirements on the annual farm labor graph no serious labor problem would occur. Walker then placed on the board before his listeners a series of graphs showing how the twin humps in California farm labor result largely from the fruit and nut crops, which are hardest to mechanize and require most hand labor in climbing trees of most of these crops in pruning, thinning and harvesting such crops as peaches, apples, prunes, apricots, oranges, lemons, etc. The big peak on the graph for all crops came in October with a maximum labor requirement of 193,910 workers. The trough in the big curve was in March, when only 44,640 workers were on the job and drawing pay. The ratio of minimum to maximum in this graph is 1 to 4.33. Hence it takes more than four times as many workers in the peak month of harvest as are needed in the slack month of March. Hence, California has had its agricultural unemployment and social-political problems that brought its harvest of such literature and movies as "Grapes of Wrath" to spotlight the farmer up as a rich baron crushing labor under his heel. The political Do-Gooders with the commy fringe on top mobilized at Washington and around the college halls have followed up such literary jibes to smear California agriculture as an exploiter of labor.

Conflicting harvesting seasons for deciduous fruits, nuts, grapes, tomatoes and cotton are the chief contributors to this mountain peak in the labor graph, Walker pointed out. But he then took a separate graph for fruit and nuts to show it was the big offending group with a 1 to 7.85 ratio of high and low labor use. In contrast, the vegetable curve showed a minimum to maximum ratio of 1 to 2.55.

Walker then took the field crops curve and separated cotton to give a separate curve that proved cotton is the big offender in field crop labor peaks in the annual graph. But he then pointed to the paper coming later in the program by Jim Fairbank, the University of California Extension engineer working on cotton mechanization. Fairbank now concludes that one picking machine replaces 25 hand pickers and with 850 machines in California the past record cotton picker it is only a matter of how soon enough machines get from factory to field to flatten out that fall peak to bed sheet smoothness as neat as the labor curves for rice and grain. A labor demand of 96,360 workers was required for that 1948 crop when only about half as many picking machines as appeared last fall were available. New practices that will eliminate hand hoeing and thinning are coming up to cut down the spring peak in all the row crops.

In the vegetable labor field Walker frankly admitted he was getting into the field of speculation, but he was also tossing a challenge to the farm machinery industry to go on and meet the demands of the situation and the farmers by mechanizing completely. There is already being bred a tomato that will stand machine harvest and considerable progress has been made at the University plant breeding plots in this field. One rugged old blacksmith gadget builder near Stockton had an order from a canning factory not long ago to build a machine to strip the tomatoes for sorting into three grades—red, pink and green—to be handled for

International TD9 pulling International's subsoil in the tight San Joaquin Valley W ment Co., Fresno, Reedley and Madera, farming in the



An Allied Equipment Co. sold and serviced International diesel TD14 pulling heavy duty Dyrr disk harrow preparing cotton seedbed in the Fresno area.

Dyrr chisel, which breaks the impervious
t Side. Sold and serviced by Allied Equip-
here much of the richest irrigated cotton
ritory is located.

Allis-Chalmers HD14 diesel tractor pull-
ing two-row Marbeet harvester in the
Salinas Valley. Sold and serviced by
E. C. Lingston Co., Salinas, Calif.

fresh fruit, canning and pickling. Onions, carrots, celery, cabbage, cauliflower are all getting attention from both growers and University engineers and plant breeders. In between the two groups are the diesel dealers with skilled agricultural sales engineers helping with advice and special service.

The fruit and nut labor problem, Walker admitted, is the toughest mechanization field of all in agriculture. Yet, machines are already succeeding with at least four in production at little shops at Woodland, Manteca, Rio Vista and Bakersfield. These eliminate ladders and are cutting costs in half in several orchards in the San Joaquin and Sacramento valleys. Yet it hardly seems likely, says Walker, that large blocks of man labor can be cut out of the nut and fruit crops such as have been done with cotton, rice, grain, sugar beets and alfalfa. But he figures one-half this tree labor can be cut out and do much towards reducing the annual labor peaks and resulting social troubles.

Following the paper on "Getting the Most Out of Farm Machinery," by Waldo Weeth, the Cotton Mechanization paper by Jim Fairbank, of the Agricultural Engineering Extension Department, and K. O. Smith, of the USDA cotton station at Shafter, pointed up a diesel powered mechanization being worked out on the irrigated cotton ranches in the San Joaquin valley. Today as this is being typed, reports of a sale of one grower's cotton crop from this area dramatizes the story in figures—$6,000,000 for this 1949 cotton yield. While the Fairbank-Smith paper did not go into the diesel power in the upsurge of mechanization, the Waldo Weeth talk was a real text book on what the diesel tractor is doing in California farming in lifting it up to new high standards with efficiency. Skilled labor instead of stoops, better farming with more crops and live stock, elimination of child labor from the cotton fields, better education of the workers' children, better housing of labor, more hours of work for each skilled worker to anchor him on the farm the year round, less disgruntled migrant labor to call for relief in the community. And Weeth says his three diesel crawler tractors are going all the time, year-round, night and day running if needed. But listen to Weeth as the writer did at this meeting, for this fellow has both Government service and fifteen years of practical farming on top of his college course at Davis, where he was talking:

"In 1943 the first International Harvester pickers came to the West Coast and into our district. Their success told us we should discard our $17,000 worth of strippers and wait for pickers, but the war halted further activity along this line until 1947. We were determined to pick our cotton mechanically or not grow cotton. The picture movie I am showing has nine mechanical pickers in it. In 1948, two machines picked 360 acres in three months. It cost $42 a bale compared wtih $49 for hand picking. One machine was the Rust picker on an Oliver tractor. That Rust machine is the forerunner of the Allis-Chalmers, which will be on the market soon. We farm 4,500 acres. We now have this equipment: three D6 Cats; three John Deere 55 combines; seven International Farmalls; one recleaning plant; one spray rig; four International cotton pickers; four light trucks, four pickups, and a full string of cultivating and land conditioning tools powered by the diesel and lighter tractors. We ran the machines every day with a seven man crew in harvesting our cotton. Each man had one day off every week. Pay schedule adopted was $1 an hour, or $2.50 a bale, whichever was greater. The men were furnished good housing free. But we reserved the right to replace any man who didn't hold up his end of the deal. It didn't take the boys long to learn that all four machines must do equally well to make them the most wages. At the end of the season they found they earned over $15 a day each plus housing.

"In 1948 our cost of mechanically picking cotton was $42 a bale, taking in depreciation on machinery repairs, cotton loss in field, etc. In 1949 our cost was down to $27 a bale. We determined the cost of hand picking by checking our neighbors and found it was $49 a bale at a $3 per hundred wage. Hence, our machine cost was $22 a bale less

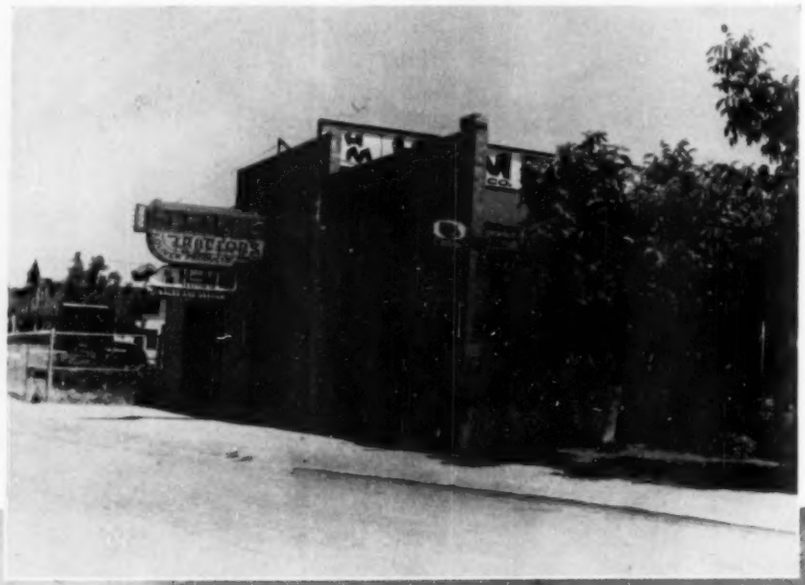
than hand work, and we have not at this point reached perfection.

"What will become of the migrant hand labor? If our records are any criterion, the answer is not as black as it might seem. When the tractor replaced the horse, did it increase or decrease labor requirements? We know now that it increased labor needs many times. It did cause some transition of labor. The same thing holds true for cotton mechanization. The press can aid in this transition period by emphasizing the merits of mechanization. It has always made more jobs—not less."

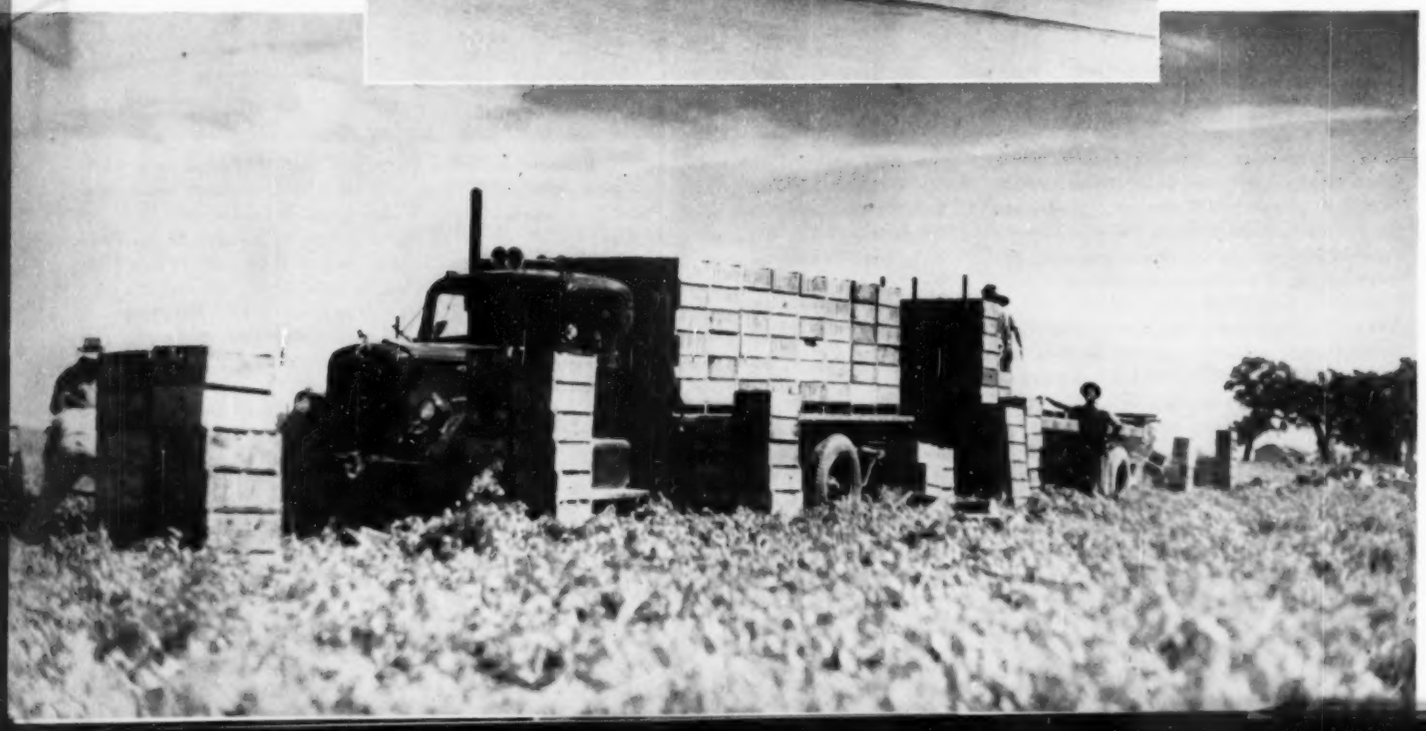
"Ten years ago we had seven steady men and hired say 100 migrant hand pickers to harvest our cotton crop. Then we had 840 acres of cotton compared to 800 last year. Our grain acreage was about the same, but we have added live stock and alfalfa since we began mechanizing. In 1940, the labor figures were: Seven men, 10 hours for 26 days a month, or 1,820 man hours; for 12 months it equals 21,840 hours. We also used 100 hand pickers from October to January inclusive, men averaging five days of seven hours each, or 56,000 man hours of hand labor. Add the seven steady men to the hundred migrants and the grand total man hours was 77,840. Now for 1949, completely mechanized, 25 steady men for 12 months totalled 78,000 man hours.

"What happened? With mechanization: 1. We have better men working the year round; 2. We must have more supervision; 3. It is essential to diversify to give year round employment to keep good men; 4. We automatically syphon off all child labor from the cotton fields; 5. The workers' children go to school throughout the school year; 6. We build better houses to get better labor; 7. We are practicing better farming methods and doing the work more efficiently to get better yields from our land, labor, time, water and fertilizer."

One of the things that stood out at this gathering of California dealers, branch managers and jobbers of farm machines was the fact that practically all of them are or will shortly be dieselized. Besides the four crawler lines which are practically all diesel powered, Massey-Harris has just announced its pair of wheel diesel tractors with their own engine. Deere's diesel is going strong. Case and Oliver have for months had on desert proving grounds their wheel tractors with diesel engines. Case is said to be developing its own engine, though Oliver has had Buda in its pre-war tractors and Hercules were going into the Cletrac diesels that are now part of the Oliver stable. Oliver's new wheel jobs are rumored to have neither of those old makes, but a competitor. Even Ford, Minneapolis-Moline and Ferguson are going diesel in the British and export areas, reports from abroad say. So, the sentiment is that every one of the old timers will have at least one diesel in the field in this area soon. Sheppard, the Pennsylvania entrant, is also represented on the Coast now, and its "conversion" diesel for the International "M" is causing a lot of talk. So, diesel is in the air for 1950 and before the year ends every full-line tractor builder is expected to have at least one on the market. Another outstanding straw in the wind observed at this conference is the unanimous adoption of hydraulic controls on all tractors from the biggest to the smallest riding models. The Ford-Ferguson battle has forced the all-wheel tractor builders to get in line—but fast.



Oliver Dealership at Stockton, where diesel crawlers are sold and serviced and the diesel-powered Hahn and Mehrten rice combines were built to the orders of rice growers during the war and post-war high prices. They also handle Oliver wheel tractors and expect the big sizes will be dieselized soon, as Oliver has been field testing their new line of diesel wheel tractors for some years and are ready to announce them soon.



Tomato harvest in the Woodland, Calif., area. Diesel truck and trailer loading boxes of tomatoes in the field daily as hand workers pick them. This is one vegetable that University engineers and plant breeders are working to mechanize all the way from the diesel seedbed preparation to the diesel trucking seen here. A tough-skinned tomato that can be stripped is being developed, to permit stripping and loading by machine.

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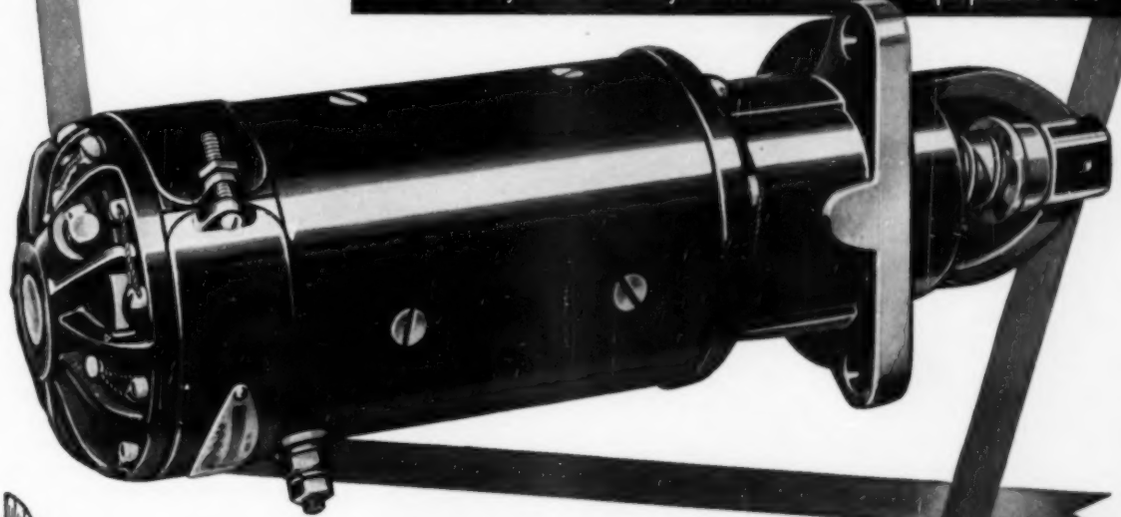

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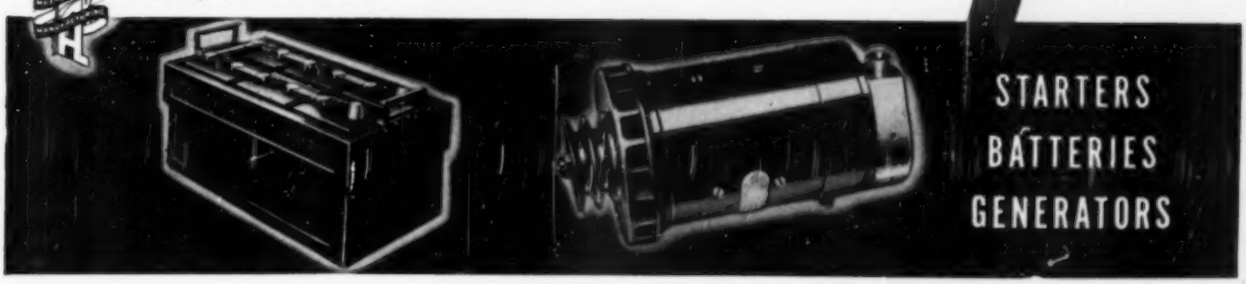
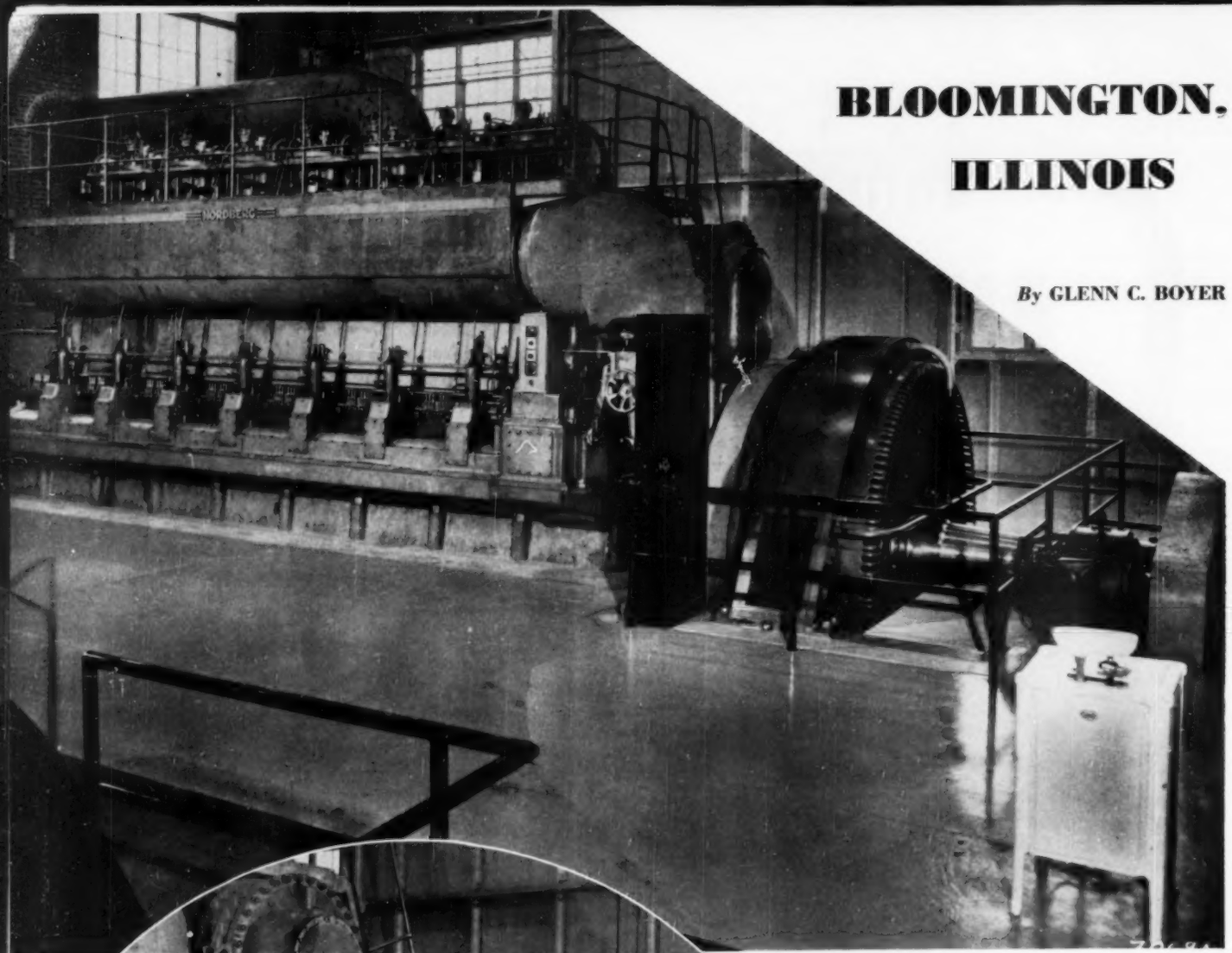
Thursdays—CBS Television Tuesdays

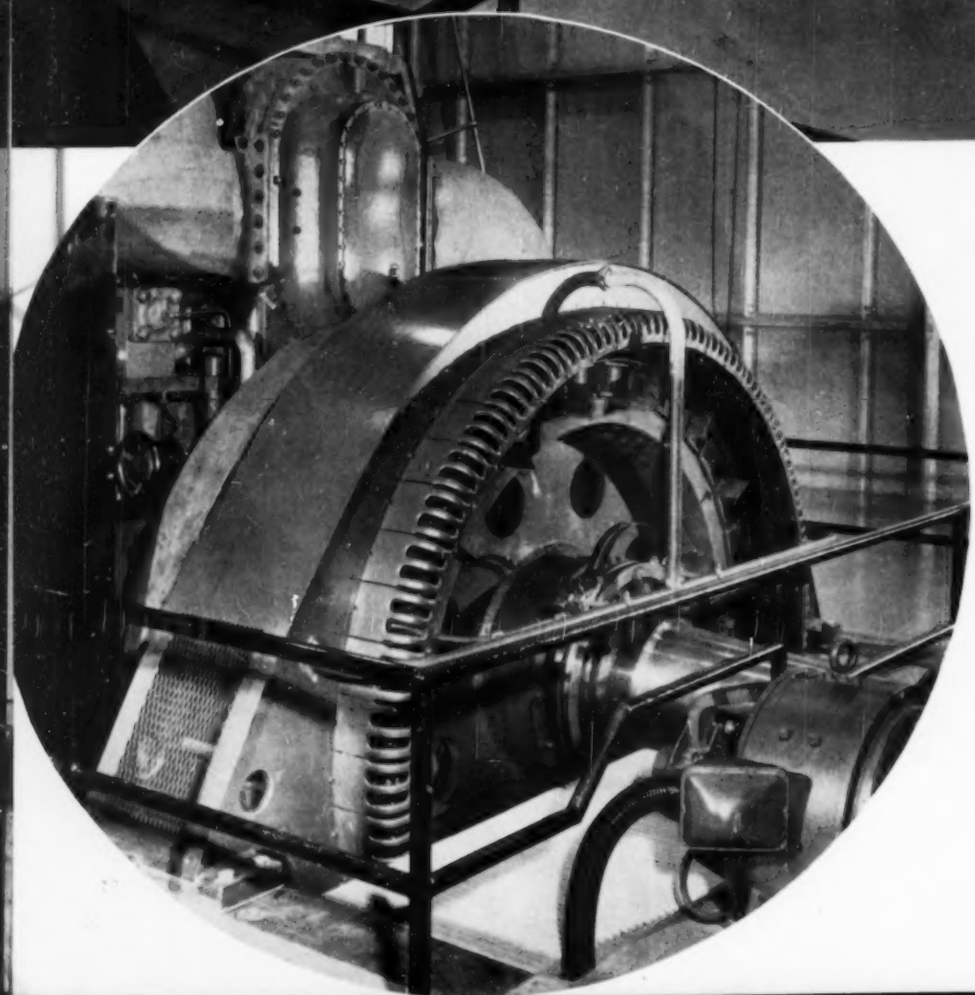


STARTERS
BATTERIES
GENERATORS



BLOOMINGTON, ILLINOIS

By GLENN C. BOYER



FOR three-quarters of a century Bloomington, Illinois, has been supplying water to its citizens. For fifty years it has been in the electrical business. Today it is supplying water to all of its citizens, lighting its streets, and supplying electricity to a limited number of commercial and residential consumers. The citizens of Bloomington are now looking forward to the day when all the utility services needed by the community will be supplied by a community-owned system. The development of the city's electrical business is so intimately linked with the development of an adequate water supply that the history of the two developments can hardly be separated. The water works was started in 1875 with an open pit well on the site of the present electric generating station. In 1899 the city started its own street lighting system. Although the Bloomington Electric Light Company tried to buy the electrical plant from the city shortly after its installation, the move was never successful. In 1907 two-phase alternating current was introduced on the city system. When it became necessary for the city to enlarge its water works installation in 1909, electric water pumping

was substituted for the previously steam-operated pumping units. It was then that Bloomington established the policy of generating the electricity needed for its own needs. There were many at that time who wanted the city plant to sell electricity to all residents of the city, but the policy of general distribution of electricity was not adopted at that time.

For the next twenty years, the city of Bloomington continued to supply water and street-lighting service from the original water works site. In 1929 it became necessary to find a new water supply. Because of the cost of the new supply—a lake approximately 15 miles from town—and because the city did not possess the bonding power necessary to finance the water works improvements, a private water company was formed to finance and build the necessary facilities. The private water company, in attempting to carry out the policy of the city to supply power for its own use from its own plant, applied to the public service commission for a certificate of convenience and necessity to construct a transmission line from the city power plant to the lake site to supply power for water pumping. The local power company offered to sell the water company power at the dam site, and in return take power from the city's plant in Bloomington. The public service commission denied the water company permission to build the transmission line. Citizens of Bloomington, far from pleased with this turn of affairs, insisted that their city start active competition with the Illinois Power Company for business in the city. As a result of this insistence, the city started active competition for electric business in 1930. In 1932 a diesel engine generating station was built by the city on the old water works site and three 750 bhp. Fairbanks-Morse units were installed. A fourth unit, a Worthington engine of 750 bhp. capacity, was added in 1940.

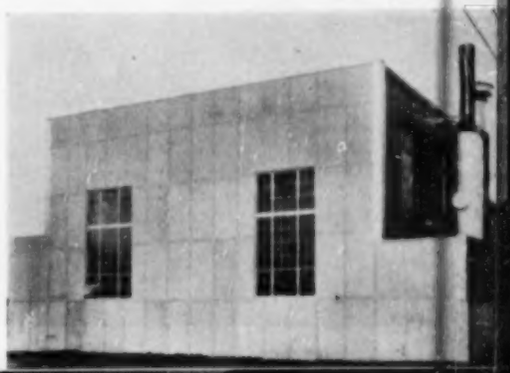
The latest addition to the plant is a Nordberg 2,800 bhp. diesel engine placed in operation on November 23, 1949. This unit is part of the city's long-range plan to remain in active competition for electric utility business in the community with the Illinois Power Company. There are many interesting features in this latest addition to Bloomington's utility plant. The new engine is a seven-cylinder, 21½-inch bore by 29-inch stroke, two-cycle, 225 rpm., blower scavenged diesel. It is equipped with individual fuel pumps for each cylinder. Timed force-feed lubrication is provided at six points on each cylinder. A governor controls engine speed. The scavenging blower is driven directly from the engine crankshaft. Engine controls are centered on a self-supporting cubicle where cooling water, lubricating oil, fuel oil, and starting air pressure, as well as exhaust gas temperature, may be read, and where starting switches are located for the auxiliary lubricating oil pump, jacket water pump, raw water pump, and barring gear motor. The generator has a capacity of 1,980 kw. at 0.8 power factor, three-phase, 60-cycle, and is wound for operation at either 4,160 or 2,400 volts. The necessary flywheel effect is incorporated in a flywheel located between the engine and generator. Excitation for the unit is furnished by a 25 kw. shunt-wound, belt-driven, dc unit, operating at 125 volts and 1150 rpm.

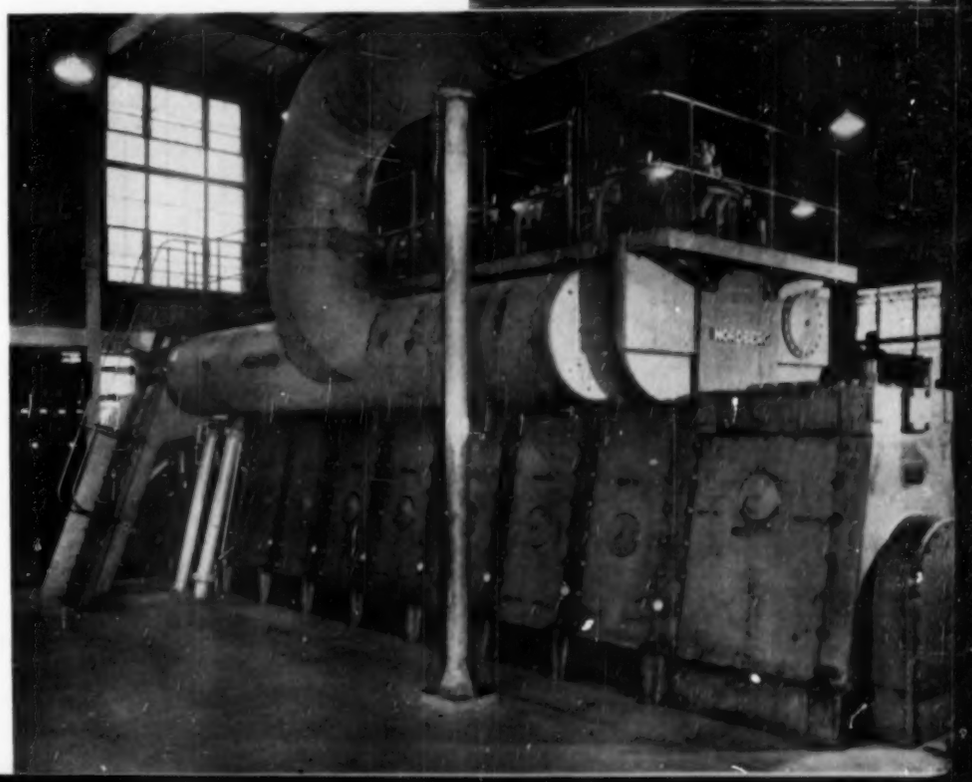
All auxiliary equipment for engine operation is located in the basement. It consists of a starting air tank and motor driven starting air compressor, lubricating oil filter, auxiliary lubricating oil pump, duplex lubricating oil and fuel oil strainers, shell-and-tube lubricating oil and jacket water coolers, raw water pump, jacket water pump, and emergency cooling water pump. The latter pump is arranged to be used for either raw or jacket water service. Intake air is filtered by sixteen 20x20-inch stationary filter cells, after which it is passed through an intake air muffler. Hot water heating coils, installed in the exhaust muffler supply hot water for building heating. Considerable care has been used in planning the piping system for fuel and lubricating oil, cooling water, and starting air to ensure accessibility and ease of operation and maintenance. All piping is welded. A color scheme has been used for painting all piping to aid the staff in operating procedures. Engine jacket water is cooled in a closed system by means of shell and tube type heat exchangers. Lubricating oil is cooled by raw water through a heat exchanger.

Fuel oil storage of 152,000 gallons in four tanks is available. Fuel is delivered by railroad tankcar to a spur located on the plant site and pumped to tank storage. A 10,000-gallon lubricating oil storage is also provided. The new Nordberg unit is housed in a 39x77-foot addition to the power plant building originally constructed in 1932. The floor arrangement provides for a shaft centerline spacing of 22 feet 6 inches between the latest unit and the next engine to be installed. The building is 33 feet in height above the operating floor. Basement depth is 10 feet 6 inches at the engine end of the unit and nine feet along the engine foundation and the generator end of the unit. The substructure is of reinforced concrete, while the superstructure is brick and steel frame. The south wall of the addition is faced with flat transite sheets to facilitate plant extension at a later date. A chain hoist with travelling dolley hung from a roof beam on the centerline of the unit facilitates engine maintenance. The switchgear installed with the new generating unit provides control facilities for the generating unit and five feeders. An overhead cable connection is installed between the bus of the original gear and the new installation since the two switchgear sections are located some distance apart from each other.

List of Equipment

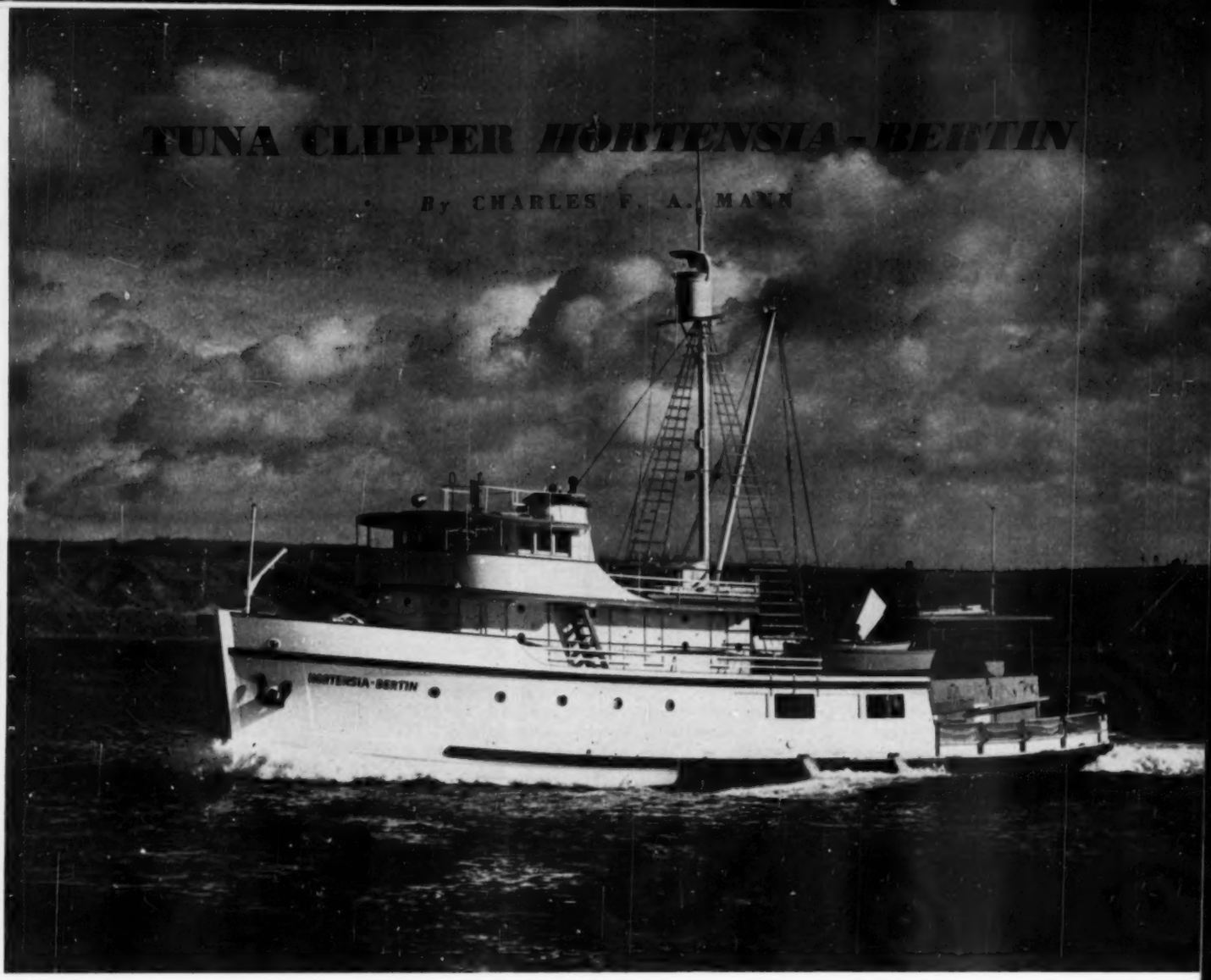
Air Filters—American.
Auxiliary Lube Oil Pump—Blackmer.
Emergency Pump—Allis-Chalmers.
Exhaust Silencer—Maxim.
Force Feed Lubricator—Manzel.
Fuel Oil Filter—Nugent.
Fuel Pump—Bosch.
Generator—Elliott.
Governor—Woodward.
Intake Air Silencer—Maxim.
Jacket Water Cooler—Ross.
Jacket Water Pump—Allis-Chalmers.
Lubricating Oil Cooler—Ross.
Lubricating Oil Filter—Hilco.
Raw Water Pump—Allis-Chalmers.
Scavenging Air Blower—Roots.
Starting Air Compressor—Ingersoll Rand.





TUNA CLIPPER *HORTENSIA-BERTIN*

By CHARLES F. A. MANN

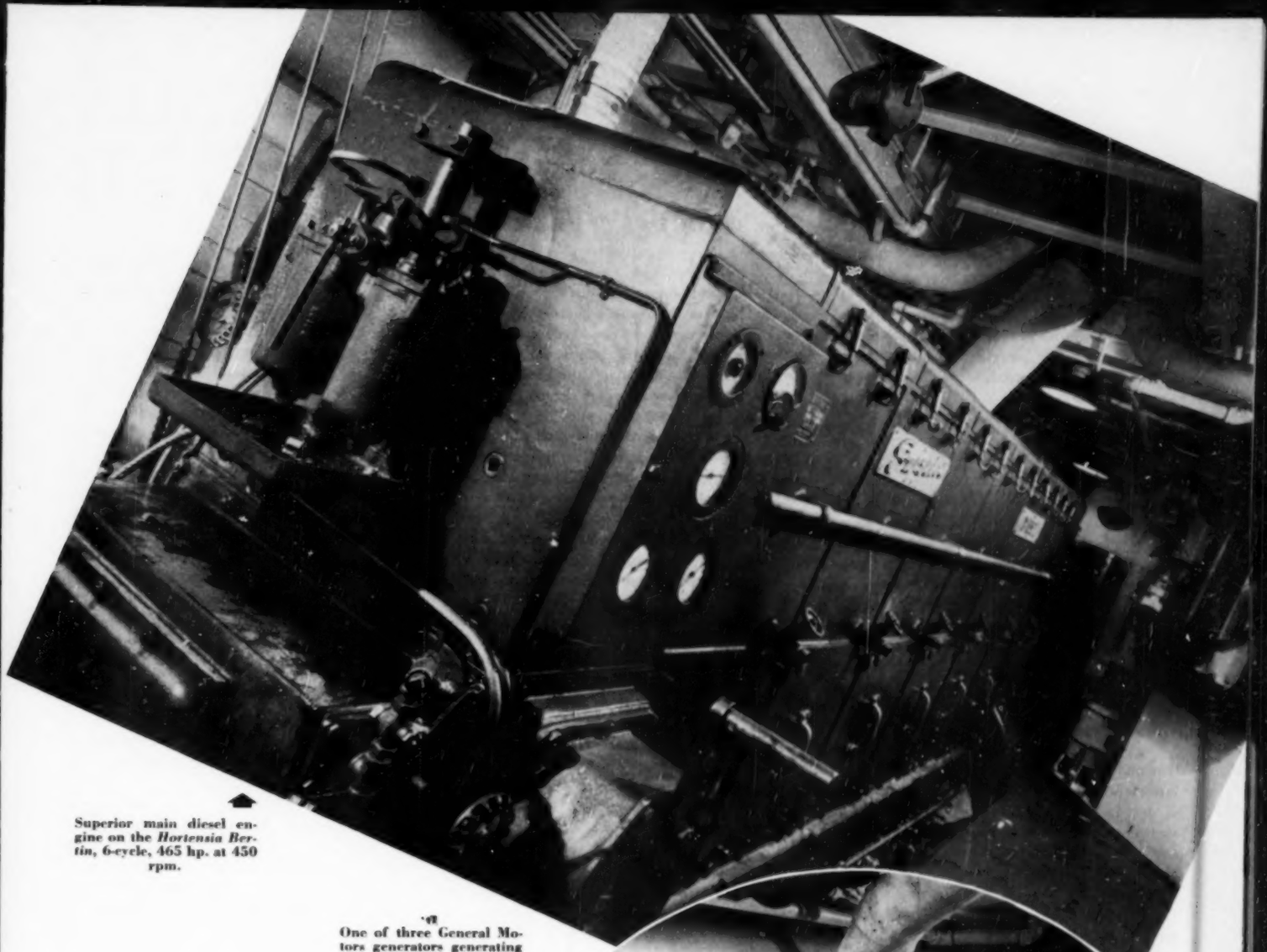


FOLLOWING by a few months the successful completion of the fine clipper *Yolande Bertin* previously covered in DIESEL PROGRESS, Capt. C. E. Bertin of Los Angeles took delivery in February of a second heavy wood diesel tuna clipper, named for another member of his family, *Hortensia Bertin*. Latest in a long line of large Pacific Coast fishing vessels built by Tacoma Boatbuilding Co., Inc., on City Waterway, Tacoma, the *Hortensia Bertin* is one of the model middle-size clippers turned out on Puget Sound in 1949 and early '50. She was designed by the firm of Wilvers and De Fever, of San Pedro, Calif., with Arthur De Fever in direct charge of plans and construction supervision, representing the owner, Capt. Bertin, a veteran fisherman and Southern California capitalist.

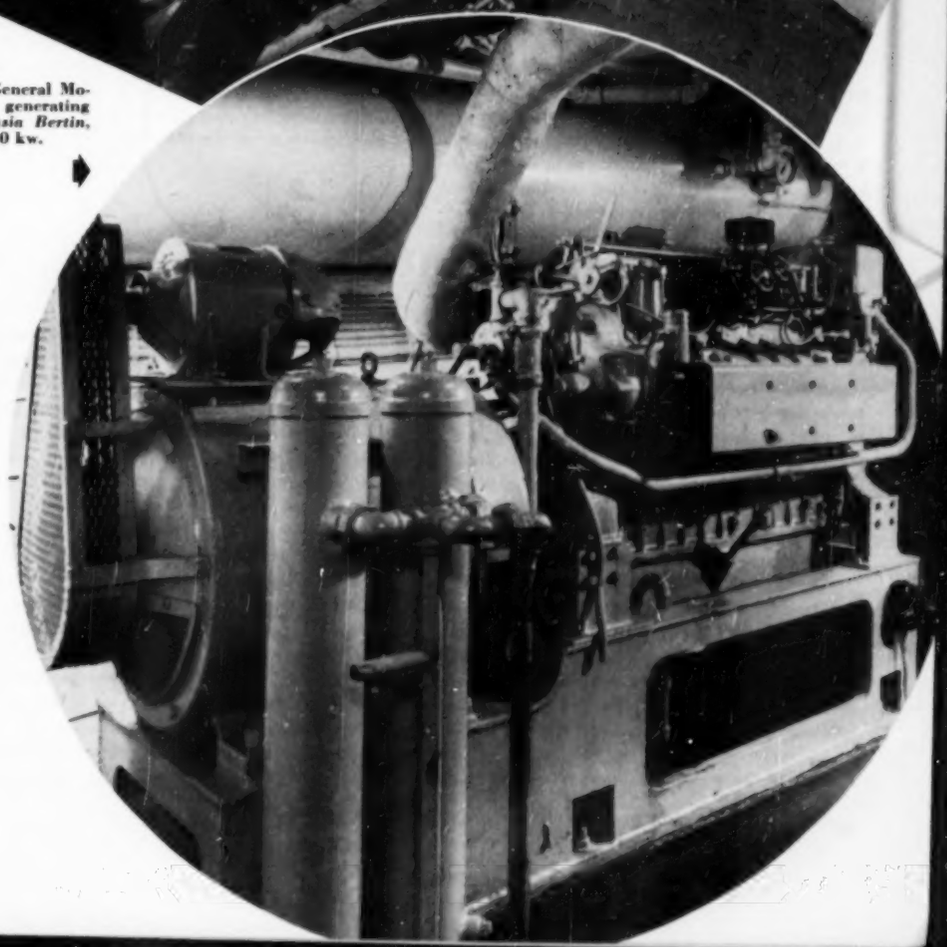
Hortensia Bertin is 103 feet by 25 feet 4½ inches by 12 feet 11 inches depth (molded at side), in principal overall dimensions. She carries a total of thirteen fish holds, including the three refrigerated combination fish hold bait boxes on deck and four steel combined wells and oil fuel tanks used as tanks outbound, and for frozen fish inbound. Below, the vessel is almost 100 per cent tanks and fish hold and fish hold-tank space, outside the engine room space forward, and the chain locker. The main deckhouse has the roomy, hotel-equipped galley-messroom, refrigerator stores space, toilet room, bosun's stores and upper engine room flat, containing the machine shop and refrigeration compressors. The raised deck has space for the captain, engineers and crew's quarters, radio room, net lockes and toilet facilities. Only the pilot house-chart room is located atop the deckhouse, and the muffler section of the exhaust system.

Of heavy Douglas fir construction, the ship compactly embodies in exact duplicate everything required to make it a profitable fishing machine, and pack home 185 tons of frozen fish from distances up to 3,000 miles from Southern California canneries. The bait wells and fish tanks embody a novel construction of two glued thick timbers and plywood, glued, nailed and screwed into a strong, watertight assembly, while the deckhouses are entirely faced in watertight plywood. Magnesite and linoleum flooring are laid throughout, and the 50-foot mast has a conventional crow's nest equipped with intercommunication system direct to the pilot house. An 18-foot Western Fairliner power launch, with 115 hp. Chrysler marine gas engine, is carried on the upper deck.

The main engine is a Superior six-cylinder 12-inch by 15-inch diesel, developing 465 hp. at 450 rpm., equipped with Ross heat exchanger for fresh water cooling. Full pilot house control is provided. Auxiliary power for the heavy electric load is provided with three General Motors diesels, developing 100 hp at 1,200 rpm. Each drives a 60 kw. three-phase 220 volt 60 cycle Electric Machinery Company's alternator, and the diesels are fresh water cooled through built-in heat exchangers. Two 20-inch by 96-inch steel air bottles are provided for main diesel starting. A Worthington 10 hp. two stage air compressor is provided. Jacuzzi salt and fresh water systems are provided. The elaborate oil, fuel, bait water, salt water for cooling heat exchangers and ammonia pumps are all Fairbanks-Morse, motor driven. Twelve brine circulating pumps, also Fairbanks-Morse and of 2 hp. size, are also fitted,



Superior main diesel engine on the *Hortensia Bertin*, 6-cycle, 465 hp. at 450 rpm.



One of three General Motors generators generating sets on *Hortensia Bertin*, rated at 60 kw.

as well as Fairbanks-Morse fire and bilge pumps. Some thirty pumps are fitted in this ship.

Sperry electric steering is provided, and three 5½x5½-inch two-cylinder Home ammonia pumps with the newest wrinkle in design and installation are fitted, each with a 20 hp. Master motor. Propeller is a special design Coolidge bronze wheel; monel metal tailshaft, Goodrich cutless rubber bearing. Total fuel capacity, including the dual purpose fish holds, is 30,000 gallons, and fresh water is rated at 2,000 gallons, while 400 gallons of lube oil are carried. Northern Line anchor winch and Northern Line cargo hoist, each from the Tacoma Boatbuilding Company's own line of auxiliary machinery, are each powered by 10 hp. motors. The winch has pushbutton control at the end of 20 feet of electric cord. CO-Two Fire Equipment Company's gas extinguisher system is provided. Northern two-way radio and Kellogg direction finder is fitted. *Hortensia Bertin* left for Central American fishing grounds from the Tacoma yard during the first week in February.

PILOT INJECTION FOR DIESEL ENGINES

By **DOUGLAS SHEARING**

ONE of the most interesting items exhibited at the British Automotive and Motorcycle Show in New York, which was held during the middle of April, was the pilot injection fuel pump at the C.A.V. Limited booth, which we are describing in some detail hereunder.

Fuel injected into the combustion chamber of an oil engine does not commence to burn immediately, although the temperature of the air charge may be ample for ignition. There is a short, but quite definite and measurable interval of time, known as the delay period, during which the fuel must be heated to its spontaneous ignition temperature. This temperature varies, of course, according to the quality of the fuel, and especially its cetane number. The delay period, or time lag, will depend further on the degree of fuel "atomization" achieved and on the rate of transfer of heat from the compressed air charge to the fuel. The latter factor will in turn depend on air density and movement within the chamber.

The influence of the delay period on the combustion of fuel in the compression ignition engine is well known. In particular, it is the cause of the uncontrolled burning of the first part of the fuel injected into the combustion chamber, giving rise to an excessively rapid pressure rise and the consequent characteristic sharp noise known as "diesel knock." The rapidity of the pressure rise when active combustion begins at the end of the delay period depends largely upon the amount of fuel which has been injected during that time. It follows that if the delay period can be shortened, or alternatively if the rate of fuel injection can be reduced during the delay period, the ensuing rate of pressure rise will be reduced with benefit both in reduced engine noise and shock loading on the running gear. The first alternative, the shortening of the delay period, requires in a given engine an improvement in the ignition quality of the fuel, that is, an increase in the cetane number. Unfortunately, as some of the leading authorities on oil production have pointed out, the future economics of crude oil refining are more likely to lead to a reduction in the cetane number of available diesel fuels, than to an increase. The second alternative, the reduction of the initial rate of fuel delivery, commonly called "pilot injection," has long been known to be effective in improving the control over combustion, and many designs of fuel injection equipment have been patented which claim to achieve this result. Until recently, none of them has been sufficiently practical or suitable for adoption with high speed engines such as are used for road transport, and many marine and industrial applications.

Interest in the possibilities of such a system has been stimulated both by the warnings of eventual deterioration in the ignition quality of fuel and by a growing desire amongst operators and the public for quieter engines. Information published by the Thornton Research Laboratories of the Shell Company some time ago demonstrated the advantages to be gained by pilot injection on a bus oil engine, but pointed out the lack of practicable fuel injection equipment. It will be appreciated that one way of reducing the initial rate of fuel injection is to reduce the rate throughout the injection period. This, however, would lead inevitably to a serious loss in combustion efficiency and rise in fuel consumption, which of course could not be tolerated in this country. There are two methods of achieving the low initial rate of fuel delivery without impairing the efficiency of the combustion cycle. The first, of which the Shell Company's tests are an example, is to inject a small quantity of fuel ahead of the main charge. This "pilot" charge commences to burn after the lapse of the delay period, but the quantity is so small that the amount of uncontrolled pressure rise is much less than normal. The main charge is timed to inject just as this combustion of the pilot charge commences, and as flame has already been propagated, it is not subjected to any appreciable delay and burns smoothly under the control of the chosen rate of injection. This rate is designed to be high enough to enable combustion to be completed sufficiently quickly for the maximum cycle efficiency to be retained.

The second method avoids the mechanical complications of the distinct break in the injection involved in the first. It provides a continuous injection, the first part at a low rate lasting for the delay period, followed without interruption by the second part, at a higher rate. Thus the quantity of fuel injected during the delay period is kept at a minimum, while the remainder, and the majority of the fuel, is injected at a high rate to complete combustion as rapidly as possible, but still under control, and again retaining full cycle efficiency. The latter method has been successfully achieved by the system described in the following and now being applied to high speed passenger transport engines by C.A.V. Limited. Much development work has been followed by extended tests of the equipment under actual operating conditions and these have indicated that a very distinct improvement in quietness and smoothness of running of vehicles can be achieved. These improvements are most noticeable and are the subject of very pleasurable comment by passengers in the vehicles already operating. The characteristic diesel knock and usual combustion noise of these engines has been practically eliminated. The improvement is most marked when idling and during acceleration, and is obtained without any sacrifice in fuel consumption. The special features of the equipment consist of a specially developed injection pump, cam profile, pump delivery valve, and injector. These are described in detail in the following.

The desired rate of injection characteristic is obtained by a two-stage cam, shown in Figure 1, and giving a plunger displacement curve of the form shown in Figure 2. The pumping plunger is of the C.A.V. port-controlled type with helical spill edge providing for termination of injection according to load. Pumping commences when the cam follower approaches the top of the first stage of the profile and proceeds at low velocity over the nose on to the second stage of the cam. This phase is shown by (A) on the displacement diagram. It will be noticed that the follower is always rising during this phase, although at a low velocity, so that there is no interruption in pumping. Upon reaching the flank of the second stage of the cam, the follower is lifted abruptly and pumping continues at a much increased rate, until the injection is terminated in the usual manner, when the spill port is uncovered by the helical edge of the plunger. This phase is shown by (B) on the displacement diagram.

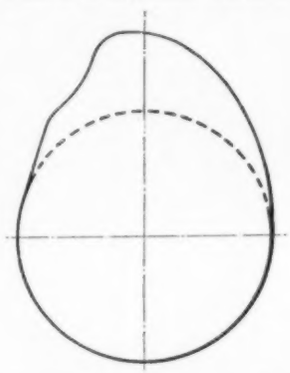


Fig. 1. Pilot injection cam profile.

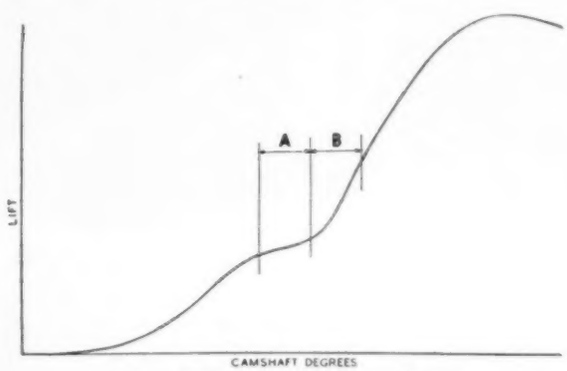


Fig. 2. Pump plunger displacement diagram.

It is found that the low initial pumping rate thus achieved does not result in a corresponding low rate of fuel injection from the nozzle unless the latter is arranged to open at a much lower pressure than that normally employed. The reason for this can be seen when it is realized that compression of the fuel in the delivery pipe must take place before a pressure sufficient to open the nozzle is obtained, and the energy thus stored produces a sudden release of fuel from the nozzle when it eventually opens, so defeating the desired object.

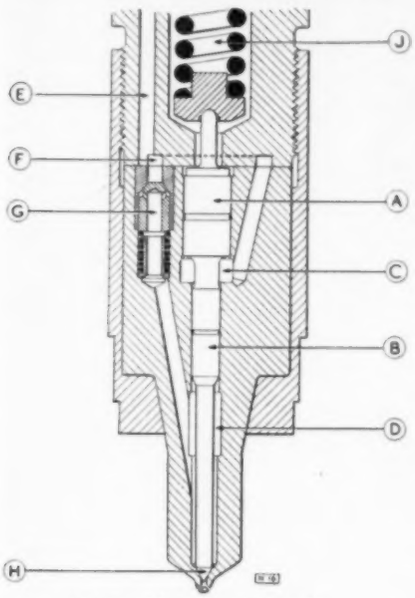


Fig. 3. Injector nozzle, in section.

Unfortunately, if the usual differential valve nozzle is adjusted to open at a fuel pressure sufficiently low for control of injection to be maintained, the pressure at which it closes on termination of injection is even lower, and will be less than the gas pressure in the engine cylinder. This would result in the nozzle valve being held open by the gas pressure until this had fallen during expansion, and hot gases would enter the nozzle, causing fouling of the injection holes and other interior parts by carbon. Such a condition is known to cause very rapid deterioration in nozzle performance, and must be absolutely avoided. The objection is overcome by the special type of nozzle shown in Figure 3. The nozzle needle has two lapped guide portions (A) and (B), forming with the nozzle body two separate spaces (C) and (D) in which fuel pressure can operate. The upper space (C) is in direct communication with fuel feed passage (E) via the annular groove (F) in the lower face of the nozzle holder body, whilst the lower space (D) communicates with the same feed passage via a small non-return valve (G). The lower space also communicates via the main nozzle valve seat (H) to the injection holes in the usual manner. The valve is held down by the spring (J). The operation of the nozzle will be best appreciated by considering the opening and closing phases separately. When pressure rises in the feed passage (E) at the beginning of injection, it operated equally in both spaces (C) and (D), since the non-return valve offers only negligible resistance to flow of fuel in this direction. Thus the effective area of the needle valve exposed to fuel pressure during the opening phase is equal to the difference between the area of the large guide diameter (A) and the valve seat (H); the small guide diameter (B) plays no part during opening. The compression of the spring (J) is adjusted to give the required opening pressure, usually 70 atmospheres, and is equal to the product of this pressure and the effective area referred to above.

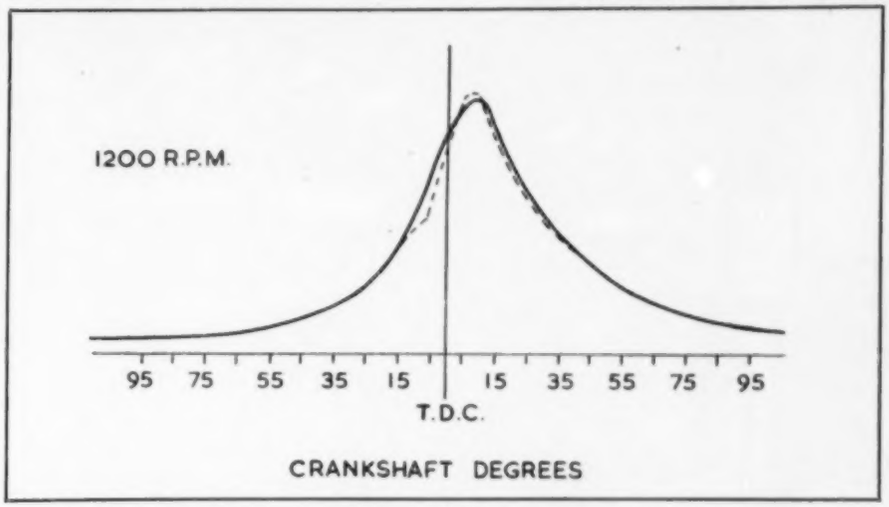


Fig. 5. Typical cylinder pressure diagram, showing smooth compression-combustion curve. (Indicator diagram for same engine with normal injection superimposed, dotted, for comparison).

When the nozzle valve has lifted, the effective area operated upon by fuel pressure is increased by the area of the valve seat (H). It is this increase in effective area which in the normal simple differential valve nozzle causes the closing pressure to be lower than the opening pressure, since the product (fuel pressure x effective area) must always equal the spring load, which is sensibly constant for the small valve lifts employed. During the closing phase, the special features of the pilot injection nozzle come into effect. Consequent upon the uncovering of the spill port of the pump by the helical edge of the plunger, fuel pressure in the fed pipe and passage (E) begins to fall, and with it that in the upper space (C) with which the feed passage is in direct communication. This fall in pressure in the upper space causes the nozzle valve to commence to close under the influence of the spring force. No corresponding fall in pressure can take place in the lower space (D), however, since flow of fuel back to the feed passage is arrested by closure of the non-return valve (G). Fuel from this space thus continues to be expelled from the nozzle holes, at a pressure determined by the downward displacement of the needle valve under the influence of the spring. The final closing of the nozzle somewhat resembles that obtained with a spring injection system, and pressure at the nozzle holes is maintained higher than the cylinder gas pressure until the final closure is made by the seating of the main nozzle valve. The essential difference between the simple differential valve nozzle and the pilot injection nozzle is that in the latter, closing of the valve is not effected by fall in pressure of fuel in the space immediately in communication with the nozzle holes, but by fall in pressure in the supplementary space temporarily isolated from the nozzle holes by closure of the non-return valve.

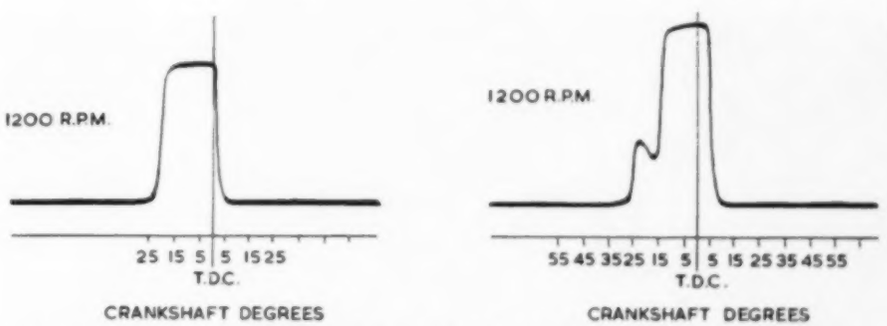


Fig. 6. Typical injector needle valve lift diagrams for pilot injection (right) and normal injection (left).

The pump delivery valve is the third special feature of the system and is also associated with the low opening pressure of the nozzle. The usual type of pump delivery valve, although provided with a retracting piston to avoid undesirable resi-

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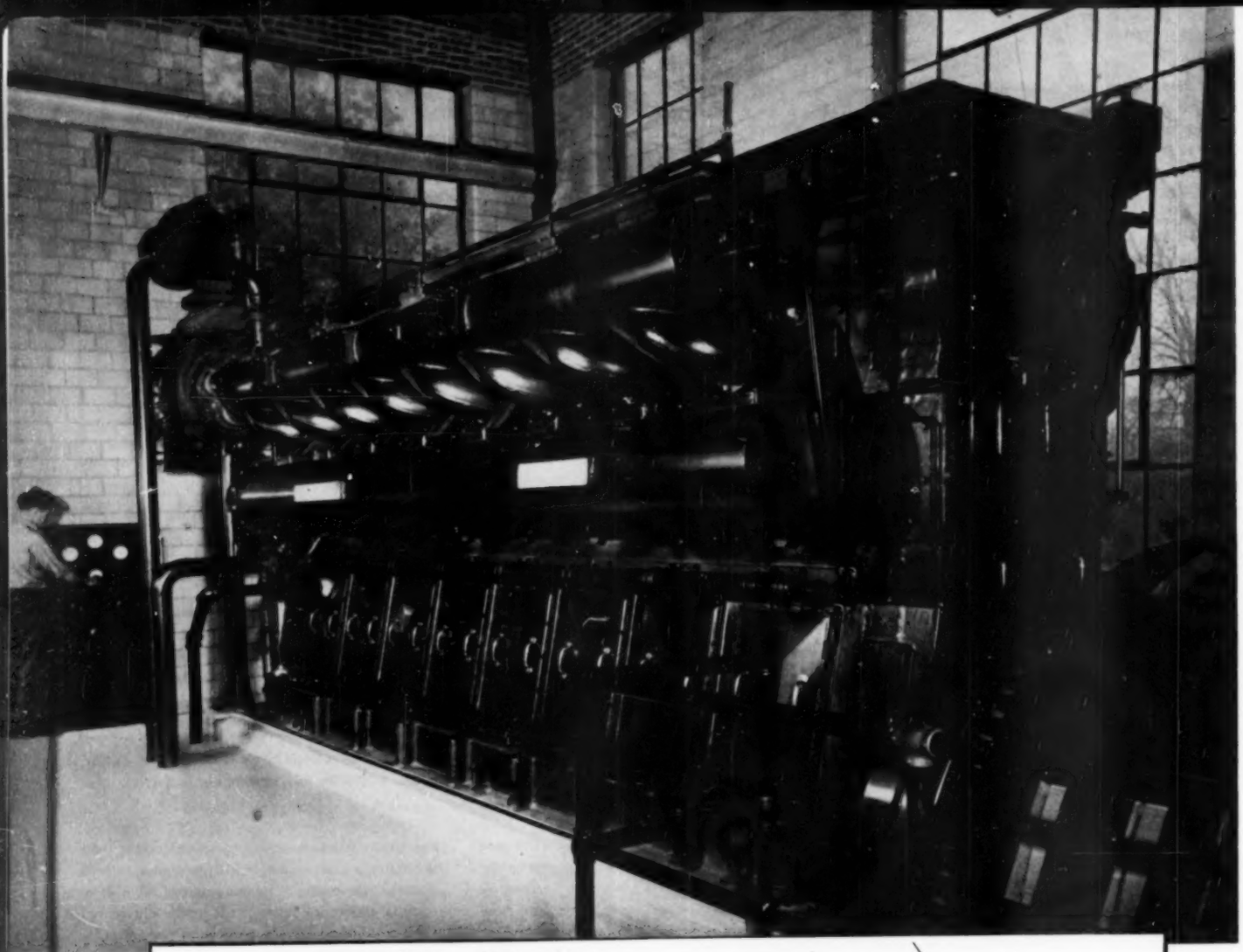
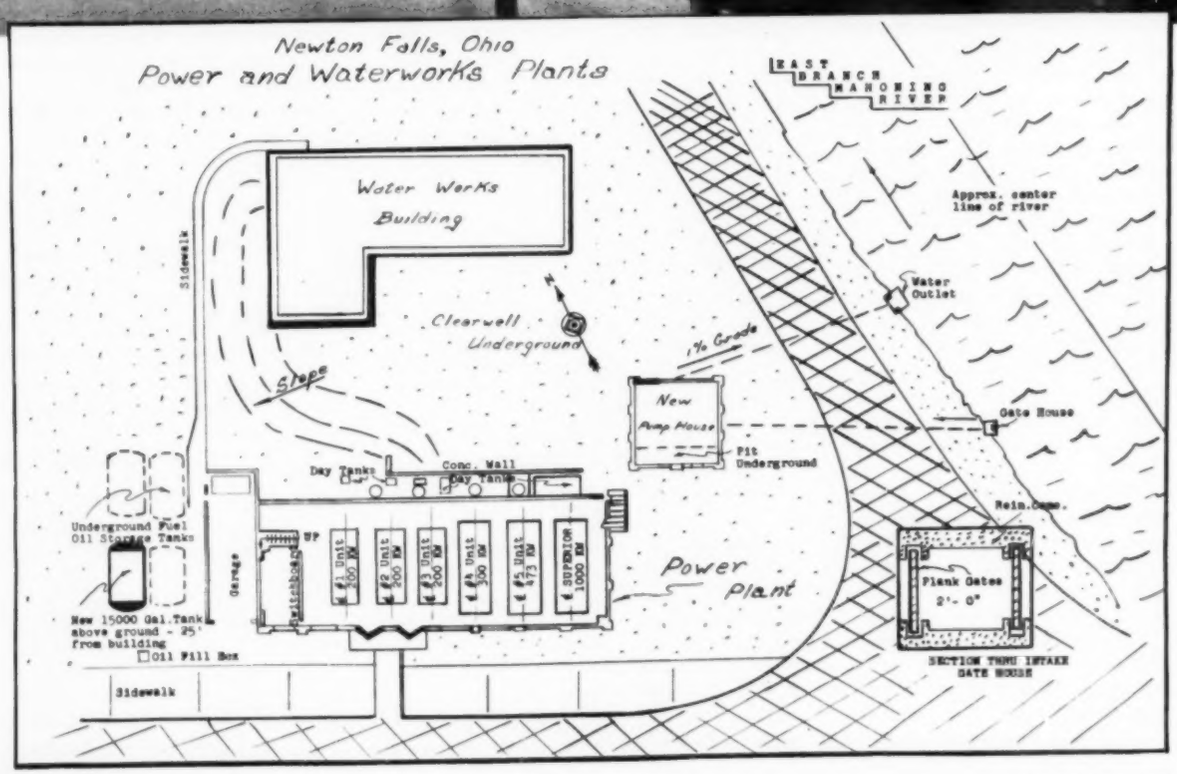



Newton Falls, Ohio
Power and Waterworks Plants
EAST BRANCH MAHONING RIVER
Approx. center line of river
Water Works Building
Sidewalk
Clearwell Underground
Water Outlet
1% Grade
Slope
New Pump House
Pit Underground
Gate House
Day Tanks
Conc. Wall
Day Tanks
Underground Fuel Oil Storage Tanks
Garage
UP
#1 Unit 200 KW
#2 Unit 200 KW
#3 Unit 200 KW
#4 Unit 300 KW
#5 Unit 473 KW
#6 SUPERIOR 1000 KW
Power Plant
Reinforced Conc.
Plank Gates 2'-0"
New 15000 Gal. Tank above ground - 25' from building
Oil Fill Box
Sidewalk
SECTION THRU INTAKE GATE HOUSE

NEWTON FALLS, OHIO

By WILL H. FULLERTON

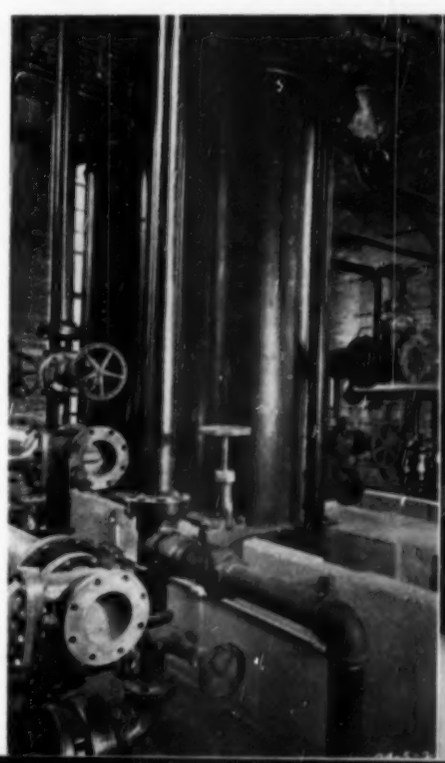
OPERATING twenty-four hours a day since January, 1949, an 8-cylinder, 1,440-hp. Superior diesel engine and 1,000-kw. generator have taken over the job of five smaller diesel generator units in the municipal power plant at Newton Falls, Ohio. By this conversion Newton Falls raised its plant efficiency from 11.8 kw. to 13.54 kw. per gallon of fuel used. The older engines now operate only during peak loak periods and during down time for the new engine. Thus permitting the new diesel to operate normally at 50 per cent to 80 per cent of its full load capacity. Operating costs have been reduced enough to take the plant out of the red and produce a substantial profit. Latest operating reports indicated net profits of almost $35,000 for the first 10 months of 1949 in the face of fuel oil prices that have doubled since 1940, when the plant began generating electric power. During the 10-month period the new diesel operated a total of 6,468 hours and produced 4,121,700 kwh. of energy. The total for 1949 is expected to be well over 5,000,000 kwh. During the previous nine years, the entire plant output from the smaller engines amounted to 25,110,000 kwh.

The 148-year-old city of Newton Falls, located nine miles west of Warren, Ohio, was first supplied with electric power as a village in 1904 by a small privately owned steam plant of about 100 kw. capacity. By 1908 the Hydro Electric and Gas Company had been organized. In 1911 the Trumbull Public Service Company was incorporated and it was taken over by Ohio Public Service Company in 1921. In 1939 court litigation resulted in a court decision permitting the village to build and operate its own plant.

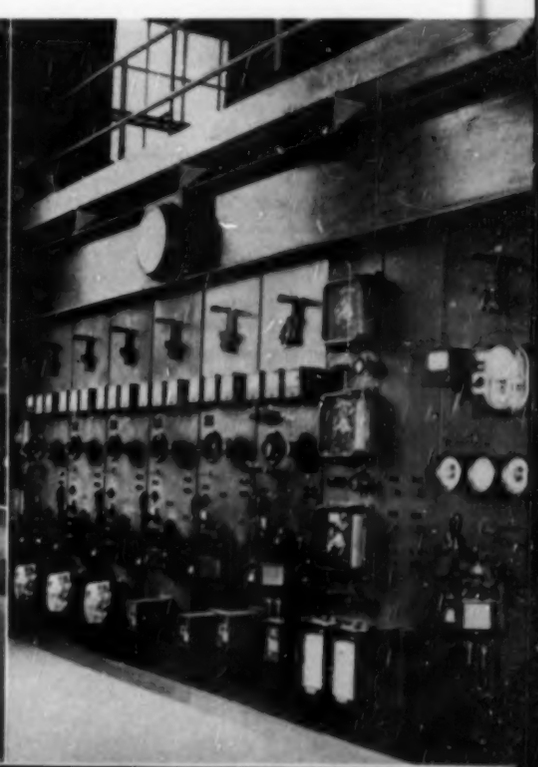
Municipal power was requested by an increasing number of civic minded residents until today this plant serves 95 per cent of the community's customers. Diesel engines were used from the start. The first three units, each of 200-hp. capacity, produced a total of 1,237,200 kwh. the first year. In 1947, power requirements had increased to 4,206,700 kwh. and two more units were purchased to increase total capacity to 1,373 kw. Rapidly climbing peak loads in the latter part of 1948 indicated that another power unit would soon be needed. Although the principal consideration in the decision to buy a sixth diesel capable of handling the whole power load was improved efficiency and lowered operating costs, there were a few other lesser factors to consider. The power house had room for only one more unit. Unless it were comparatively large, the next increase would mean enlargement of the power house or disposal of one or more smaller units. Fortunately, with turbo-supercharging the 1,440-hp. Superior engine and generator occupy but little more floor space than the 200-hp. units. Diesel fuel is stored in two underground tanks of 10,000 gallons capacity each, and a 15,000-gallon outdoor tank. A 20-gpm. pump transfers fuel oil to 1,000-gallon day tanks located in concrete pits alongside the building. These tanks are filled twice daily. Fuel oil filters are checked every three weeks by the three-man maintenance crew. The lubricating system is of the dry sump type, equipped with a full-flow strainer and filter of the paper disk type. All filtering equipment, engine oil sump tank, lube oil cooler, strainer, and motor driven lube oil pump are easily accessible in the basement. The lube oil pump is a positive displacement type that circulates oil through the filter at 500 gallons per hour. New oil, which is an SAE-30 grade, is stored in 55-gal. drums. Latest inspections showed the original oil to be clean and free from impurities. Low consumption of lubricating oil has produced an approximate net saving of $1,100 for eleven months of operation as compared with the operation of the older engines. The lubricating oil required from January to September of 1949 was 2,606 gallons as compared with 6,104 gallons during the preceding twelve months. With the new engine, 4,500 rated horsepower-hours were obtained per gallon of lubricating oil. The cooling system at Newton Falls is reported to be the first of its kind in Ohio. Engine jacket water and lubricating oil are both cooled by raw water from the river. The water flows by gravity from the river through a 24-inch pipe to a sump under the pump house. The bottom of this sump is four feet lower than the bottom of the river. Three turbine pumps of 5-hp. capacity each circulate this water through four vertical, open-head coolers with enough capacity for engines up to 5,000 hp. output. Three of the coolers are used for the engine jacket water and the fourth cools water for the shell and tube type lube oil cooler. During summer operation when cooling requirements are increased, the raw river water enters the coolers at approximately 70°F. and leaves at 105°F. The jacket water enters the coolers at 150°F. and returns ot the engine at 135°F. The river water passes from the cooler to a discharge chamber from which it returns by gravity to the river. The engine jacket water is circulated by three 450 gpm. pumps. The power plant is in charge of T. S. Kistler, who is superintendent of both the power plant and adjoining water works. Consulting engineers for the Newton Falls installation were Carl J. Simon and Associates, Van Wert, Ohio, one of the oldest consulting engineering firms in Ohio, with long experience in municipal diesel plant operation.

List of Equipment

Main Engines—Superior (14½x20 inch bore and stroke, 360 rpm., 1,440 hp.).
Superchargers—Elliott Buchi.
Generator—Ideal Electric Company.
Switchgear—Lake Shore Electric Company.
Governors—Woodward Governor Company.
Silencers, Intake—Air Maze.
Silencers, Exhaust—Maxim Silencer Company.
Injection Pumps—Scintilla-Bendix.
Fuel Oil Filters—Purolator Products, Inc.
Lubricating Oil Filters—Fram Corp.
Heat Exchangers—Henry Vogt Machine Co.
Lubricating Oil Cooler—Graham Mfg. Co.
Pyrometers—Alnor, Illinois Testing Laboratory.
Temperature Regulators—Fulton-Sylphon Co.
Water Circulating Pumps—Ingersoll-Rand.
Fuel Oil Transfer Pumps—Fairbanks, Morse.
Overhead Crane—Chisholm-Moore Hoist Co.



Vogt heat exchangers in Newton Falls plant.



Newton Falls municipal plant's switchboard.

High-Speed Diesels . . . Design, Operation & Maintenance

CONDUCTED BY H. G. SMITH

Off-Highway Garage Equipment and Arrangement

Protection of Parts • Suggested Improvements

THIS subject involves all types of equipment to a more or lesser degree. Highway trucks, busses and stationary installations do have and face the problem, but off highway machinery is burdened with it. Since ninety or more per cent of this off highway equipment is diesel engine equipped, the subject of dirt, where it should not be, should be frankly discussed. All types of road building equipment, mining and dam building use tractors, scrapers, loaders, spreaders, trucks, air compressors and the big dirt hauling vehicles are equipped with air cleaners and filters. Complete service instructions, on their care and maintenance, are distributed to maintenance crews, but one thing which will be outlined and discussed below is that what is still a big problem and not too well taken care of is repair protection.

H. G. Smith's background in diesel engineering renders his articles of great interest to those engaged in operation and maintenance of high-speed engines. From the Springfield, Ohio, Technical and Engineering school, he entered the Foos Gas Engine Company, Springfield and later, Springfield Motor Truck. With this experience behind him, he joined Hercules Motors Corporation, where he was chief engineer for many years being with them when their diesel program was started. Executive engineer for Buda during the last ten years, he recently resigned to take up consulting work.

Sufficient protection against dust and dirt in the garages, where the equipment is torn down and repaired, is the point that needs a lot of attention and improvement. Building dirt dams, digging coal and taking off the overburden in the strip mines and mining the iron ore in the iron stripping mines, call for garages at the point of operation. They cannot be located too far away from the point where the equipment is operated because prompt action is needed to keep the equipment rolling. This means that the repair work is in the midst of the clouds of dust and dirt which is always present in such operations. The writer has observed that most contractors give this subject of garage location considerable attention but, try as they will, it is practically impossible to get a location that is both satisfactory for speedy service and still away from the dirt. Even though they do get a location that seems to be in a spot where the dust will be at a minimum, sooner or later the problem becomes more serious because the vehicles and equipment coming back from the operation are usually loaded with several layers of muck they cannot avoid picking up.

Anyone who has been around some of these operations will agree that some of the equipment nearly loses its identity due to this accumulation, and when they are driven or towed into the garage big hunks will drop off on the floor and after drying out it is kicked up and deposited on everything in the garage. If there are any engines or transmissions open for inspection or repair they get their share of this coating. There are some things that can be done to diminish this coating condition. One dirt dam contractor installed a portable continuous steam generator. It was high pressure and designed so that there was no limit to the amount of steam that could be generated. Just attach a hose to it that will supply a continuous supply of water and the steam continues as long as required. It was mounted on wheels and he used it both inside and outside of the garage. If there was a piece of equipment that was covered with dirt, the generator was wheeled outside of the garage and the job of cleaning was done before it was brought inside. This piece of equipment is indispensable and would be a big money saver for any large operation or even medium size jobs. This still did not solve the entire problem because on windy dry days the clouds of dust would be blown into the garage. It was so bad at times that the writer at the end of the day looked like an Indian.

To show you how costly this condition can be, I would like to relate just one incident. One of the big dirt haulers came in for burnt out bearings on the diesel engine because of lack of sufficient oil in the crankcase. It was cleaned, disassembled and repaired and when I arrived the hauler was again ready for final test. When the starter was tried, the engine would not budge. After some discussion with the chief mechanic and the factory mechanic was on the job, it was decided to hook up the welder to the starter, it being decided that the battery might be low and since they wanted to get the hauler on the job, they did not want to take the time to change batteries. After two touches of the power the engine "broke loose" and everything seemed to be O.K. The hauler got ten yards outside of the garage and stopped. After several attempts to again start the engine, without success, it was decided that something serious was wrong and the engine would have to be disassembled. It was found that the center bearing was frozen solid to the crankshaft. Chisels had to be used to remove them. The bearings and shaft were ruined. The oil grooves were loaded with dirt. Questioning the mechanics who had performed the work brought forth the information that two days previous when the assembly was made the dust had been terrible. They felt sure, however, that the parts had been kept clean. Checking the oil and the inside of the crankcase proved otherwise. They apparently had done the best that they could, but it was not enough.

To avoid these costly failures (Saturday and Sunday work) there must be provided a cleaner condition. This can be done by properly sealing off a room of the garage, not necessarily a big room, but one that is big enough to do all the more delicate work. It should include a space for the more delicate and expensive small repair parts, parts that are easily ruined by dirt such as bearings, bushings, highly polished shafts, gears and oil seals. Usually such parts are shipped from the factory with protective coatings, but if the wrapped parts are exposed to layers of dust and dirt, some of this dirt is bound to fall on the parts when they are unwrapped. To the writer's knowledge, it has not been done, but he would suggest that these rooms be slightly pressurized to keep the dirt to a minimum. It would not cost too much and it would certainly improve the life of these parts.

Talking to the mechanics you will find that they would be for it. They continually struggle with this dirt problem and every one that I have talked with gave me their blessing if I could persuade their boss to give them something of this kind.

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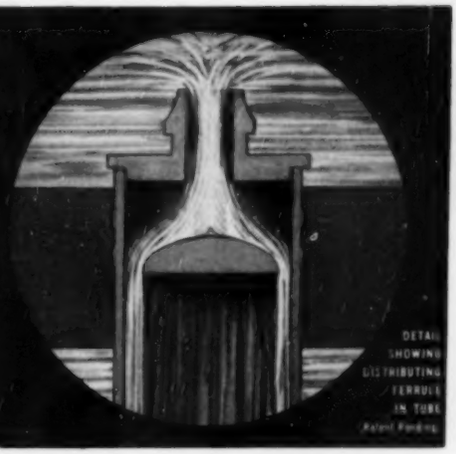
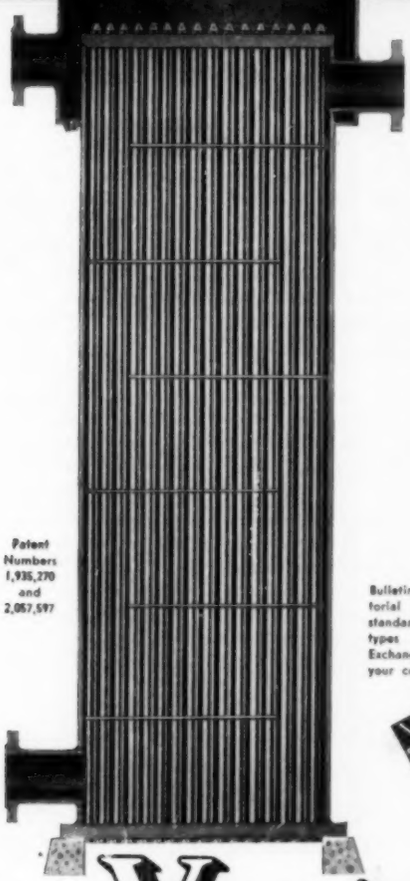
FILM TYPE EXCHANGERS



DETAIL SHOWING DISTRIBUTING FERRULE IN TUBE
Patent Pending



Patent Numbers 1,935,270 and 2,057,597

Vogt engineers have taken a familiar refrigeration plant "old timer" and developed it into this modern, efficient heat exchanger.

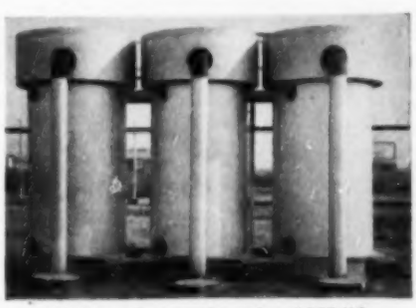
The film type exchanger operates in a vertical position. Water introduced in the top chamber is distributed in a thin film against the inner tube walls by means of special ferrules. The shell side of the exchanger has baffles arranged to provide optimum velocities, pressure drops, and heat transfer rates. Shutdowns are eliminated because tubes can be cleaned while the unit is in operation; thus permitting the use of dirty, mud and silt depositing water.

Vogt Film Type Exchangers now serve as Jacket Water Coolers, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to condense any vapor. They are also applicable for handling liquids other than water in film flow.

HENRY VOGT MACHINE CO., INC.
LOUISVILLE 10, KENTUCKY

Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas

Bulletin HE-5 is a pictorial presentation of standard and special types of Vogt Heat Exchangers. Write for your copy.



Jacket Water Coolers serving engines of 7,300 H.P. Muddy well water used as cooling medium.

Vogt

HEAT TRANSFER EQUIPMENT

Supervising & Operating Engineers Section

CONDUCTED BY R. L. GREGORY

Safety and Safety Practices in Diesel Operation

IN the last issue of DIESEL PROGRESS we promised that this issue would contain a discussion on the above subject. The reason for this promise being, that during the past year many of our communications have devoted one or more paragraphs to the subject of Safety and Safety Measures. Since we deem a safety program as a vital essential to proper continuity of plant operation and maintenance work, we are presenting this general discussion.

It will of course have to be a general discussion, due to dissimilar conditions in most plants and also due to the fact that safety covers a large field and cannot be wholly covered in the space allotted. The foundation of all safety work lies in the alertness and willingness of each individual member of the plant personnel to assume some responsibility in the program. As the old saying goes: "A chain is only as strong as its weakest link." So a safety program is only as effective as the plant personnel is willing to cooperate in carrying it on.

One of the most effective measures adopted to promote safety is to have a good working Safety Committee composed of a member of the various departments. The duty of such a committee being to make periodical inspections of equipment and plant conditions, log them as noted, and make recommendations to the plant supervisor for the correction of any conditions or faults noted. These should be in writing. Then upon the next periodical inspection these conditions should again be taken note of, as to whether they have been corrected and if not, why haven't they been attended to.

Now some plant supervisor may feel that his plant is too small to warrant such a committee. If so, let him appoint one man to make these observations and note and make that one person responsible for this safety program. In addition to such a setup, each individual member of the plant should feel it his duty to report unsafe conditions and practices to the man in charge. This is real cooperation along safety lines.

Even in the best regulated plants, accidents are often caused by carelessness and oversight, as the following two incidents will attest. The first happened in a plant of the writer's acquaintance a few years back. The plant personnel had just finished a major overhaul of one of the units and one of the operators had started up the unit. In getting set to take over the load he reached for one of the controls on the governor and in so doing stepped on a small spot of oil which had gone unnoticed. As he did so he slipped and in reaching for some support to catch himself, fell far enough forward to run his hand onto the barring gear attached to the rotor. As a result he received a badly lacerated hand and fingers. This accident could have proved fatal had he fallen a little further in and caught his arm.

Another similar accident happened in a large midwestern plant. The operator was in the basement checking his auxiliaries when the phone rang. In his hurry to answer he started up a flight of stairs, slipped on a small piece of pipe accidentally dropped by a repair man, fell and struck his head on a steel tread and was knocked unconscious. This was another accident charged up to carelessness.

Possibly the next important item in a safety program is cleanliness. This covers a multitude of sins. A good safety record cannot be maintained in a filthy plant any more than a healthy family can be expected to remain so in a dirty home. The units should be kept clean and well painted, all railing, floor plates, stairways and parts should be kept free of oil and grease. When workmen are making repairs, doing an overhaul job or maintenance job, they should be careful in using well kept tools, and it is the job of a supervisor to see that their working equipment is in first class shape at all times. Battered wrenches, chipped chisels, worn hammers, greasy equipment, etc., are all invitations to accidents. When a job is completed the tools should be returned to their respective boards, cupboards or chests after being thoroughly cleaned. Any worn or broken tools should be replaced or reconditioned.

Another feature that should be watch diligently is that of various parts of the equipment. Valves especially should be checked occasionally to see that they open and close properly, and that they seat tightly when closed. This is especially true on high pressure equipment such as valves in blast air lines, starting air bottles, drains, fuel handling equipment, etc. Also in lines supplying and discharging cooling agents. In the operation of a diesel plant one never is assured of not meeting with unforeseen emergency which will necessitate the use of these valves.

Valve packing should be checked periodically as well as the different pipe lines around the unit and any faulty equipment repaired. Steam leaks, oil leaks, water leaks are not only unsightly, but often are dangerous hazards to the safety program. Gaskets often blow out or start to seep and under high pressures sometimes go out without much warning. Keep in touch with your equipment and see that it is in safe operating condition at all times.

Another item that should be given periodical attention is the various auxiliaries. Pumps should be given special attention to see that they function properly, that the source of cooling agents is open and clean, and that the discharge lines are free from any foreign material which might interfere with correct circulation. This also includes the heat exchangers, especially the tube bundle, which is subjected to a lot of foreign matter.

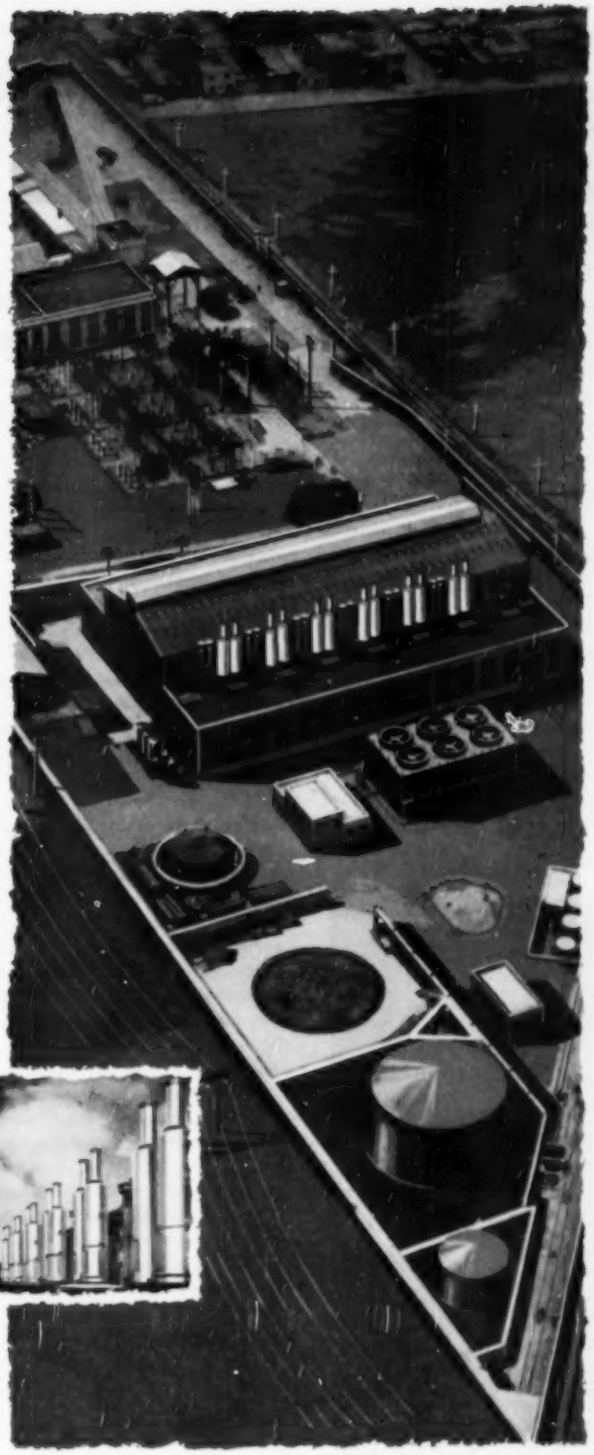
The air intakes should be cleaned frequently. There are several types of air filters, some being composed of sections of filters, all of which should be easily accessible and easily removed. Most of this type should be removed occasionally, steamed out, washed with kerosene or a light grade of fuel oil and dipped in an oil bath before replacing. Clean air in sufficient quantities is a necessity to good operation, just the same as clean water. On the rotary types of screens, many are self-cleaning, but occasional inspection of this type is recommended and where they operate in an oil bath, the oil should be changed frequently to keep it clean.

Exhaust lines and mufflers should be inspected periodically. The cleanliness of this equipment depends a lot upon combustion and proper lubrication. Imperfect combustion and over lubing an engine is not satisfactory in efficient operation and will tend to clog the exhaust sytsem. Another must in these systems is the matter of sufficient drain lines. Condensate will collect and often become quite a nuisance unless relieved. All unit bedplates should have a good system of drainage and all floors should have positive drainage from all points.

The final items to be discussed are Safety Temperature and Pressure Alarms. These alarm systems are a mighty fine thing on a unit and the writer is all for them under certain conditions. Too much confidence does not want to be placed in them as a positive alarm in case of trouble. If they are in-

. . . and now please turn to page 68 . . .

Largest Diesel Powered Electric Utility Plant in the Americas has no *Diesel Noise Problems*



Snub the Slug and Stop the Noise

The Tacubaya, Mexico City, plant, one of the largest Diesel electric power plants in operation, solved its engine noise problem with Burgess-Manning Snubbers. The six Nordberg Diesels delivering a total of 44,100 hp at Mexico City altitude, are each equipped with two Burgess-Manning Intake and two Exhaust Snubbers to effectively reduce intake and exhaust noise.

The Snubbers prevent noise by smoothing the flow of intake air and dissipating the energy in the exhaust gas slugs, providing quiet operation without affecting performance.

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Exchange Your Diesel Maintenance Ideas

CONDUCTED BY R. L. GREGORY

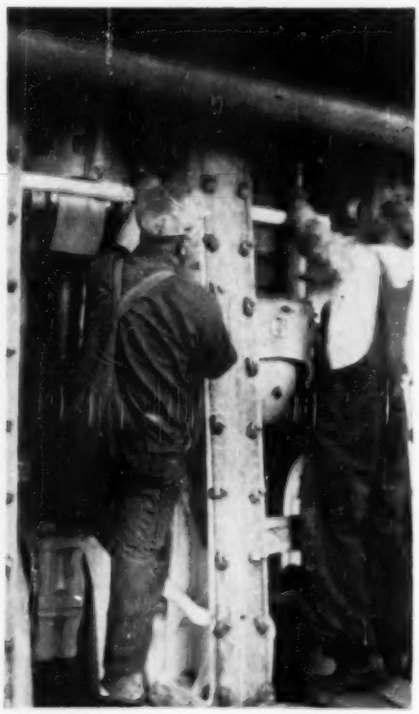
MAINTENANCE SUGGESTIONS FOR NEW USERS OF DIESEL EQUIPMENT

Part I

THE unstable condition of the coal output and the coal market for the past couple of years has caused a lot of inconvenience and loss to generating plants, both industrially and municipally owned, so much so that many of them have either converted over to fuel oil for boiler operation or have gone to diesel and gas operation.

Many of these plants which have operated by steam for years past are using their steam plant personnel to operate their diesels. Consequently said personnel is confronted with new types of problems with which they are not too familiar, but at the same time they are desirous of more information concerning the new type of equipment and the maintenance of the same.

Figure 1



We have had several requests for such information, such as maintenance schedules and procedure. Were the writer aware of plant conditions and equipment in detail, he could possibly set up a maintenance schedule and procedure which might fit these individual plants. However, not being familiar with the complete detail of plant layout and construction, the only alternative is to give a general idea on the matter. The following suggestions are applicable for the most part to new users of diesel equipment:

Establish a Routine Inspection and Maintenance Schedule

This is all important and should be religiously followed out, the procedure being based on recommendations from the manufacturer of the equipment. In stationary installations this schedule is based on the actual operating hours, where units are in practically continuous operation. If the operation of the units is confined to standby service or intermittent hit and miss operation, these schedules should be set up as semi or annual inspections.

There may be changing conditions from time to time which will warrant a change of such schedules. For instance, as a case history: one plant of which we have knowledge uses lake water for cooling purposes. This water has a wide range of temperature between winter and summer and about twice a year this lake "boils." By that we mean that there is an excess amount of dead vegetation arising from the bottom, which vegetation is pulled into the suction of the circulating pumps. This means that the strainers and tubes of heat exchangers must be inspected oftener and cleaned oftener during these periods to free them from accumulated dead vegetation and slimy deposits which form a sort of insulating covering on the tubes and decrease the transfer of heat. That is just one example.

Of course the semi and annual inspections refer to major inspections and overhauls. One must not get the idea that this is the only inspection required on diesel units. The integral parts of the unit which are functioning all the time, such as fuel injection system, air compressors on air injection units, fuel handling equipment, pistons, rings and liners along with wrist pins, wrist pin bushings, bearings, connecting rods, etc., should have a check up at least monthly, as to clearances, tolerances, etc., just as insurance against wear and tear. This is not necessary in its entirety, but should conditions develop in the process of operation which might be questionable as to their affecting efficient operation, then these inspections should be conducted and corrections made before matters get out of hand.

Naturally a new unit must be watched and inspected more often in the process of "breaking in," than one which has operated for several months and is what we term as "set." The term "set" means that the parts are worn to the point where they are functioning at their best, well lubricated, and giving the maximum of efficiency in operation.

Record All Inspections and Measurements

The recording of all inspections and measurements is a MUST, if you are to have accurate detailed information on your units. Nothing should be left to memory. Such records are invaluable to the operating, maintenance and supervisory personnel, nothing being left to guess work. When such inspections are made, which involve the dismantling of important functioning parts of the unit, parts thus removed or exposed should be well cleaned and marked, so that in reassembly no error is committed which might throw the efficient operation of the unit out of gear.

Keep Units and Parts Clean

When one is in the process of inspection, which inspection involves the removal of parts of the units, some very important points must be observed as follows:

1. Be neat and orderly, keeping parts clean and in a suitable container, especially small parts.

2. In cleaning parts use large clean rags of good quality with a minimum of lint. Don't use waste material, since cotton waste and material of this type, which material has its place in maintenance work, is not suitable for cleaning intricate parts of a unit. The lint, threads, etc., often cling to these parts, and an accumulation of them may cause unforeseen difficulties.

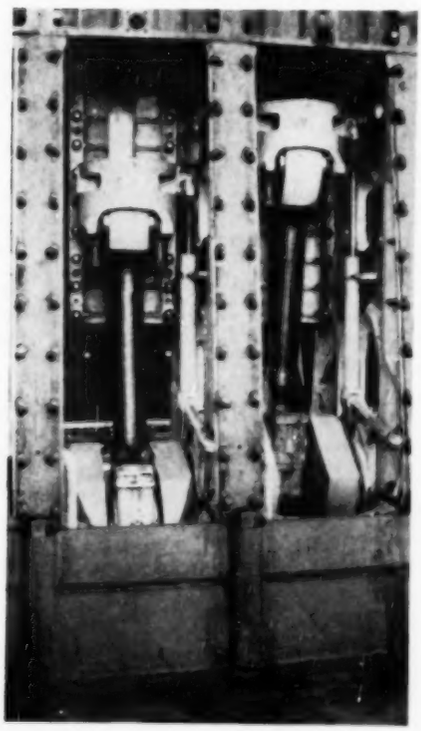
3. Use clean containers for washing parts. Don't pick up any old pail or can and try to clean parts in it. There may be foreign particles of sand, or other corrosive materials which will give you difficulties. Change your cleaning fluid often, using such fluids as light fuel oil, carbon tetrachloride, and other commercial cleaners.

4. When you have inspection doors off to work on pistons, liners, bearings, etc., use a great deal of care in keeping grease, carbon and other dirt off your shoes. It may scrape off of them and drop into the crankcase, thus causing dirty lube oil. Keep your lube oil as free from foreign matter as possible.

5. When pulling pistons, cleaning ports, wiper assemblies or doing any work on the liners, cover the crank bearings and opening into the crankcase with a piece of heavy ducking, canvas or a suitable tarpaulin. Then when removing it, take care that none of the accumulated dirt falls into the crankcase. Also be sure to check the cloths used to see that they are accounted for. Cases have been known where a cloth or wiper has been overlooked and gotten into the circulating pipes, thus clogging free circulation of the lube oil.

6. Keep oil connections tight and free from leaks. Nothing is so messy and unsightly as having a lot of leaky joints with oil seeping out and needing constant attention. Gaskets on inspection doors, explosion plates, and pipe joints should be tight and suitable to retain oil within its proper confines.

Figure 2



Painting Equipment

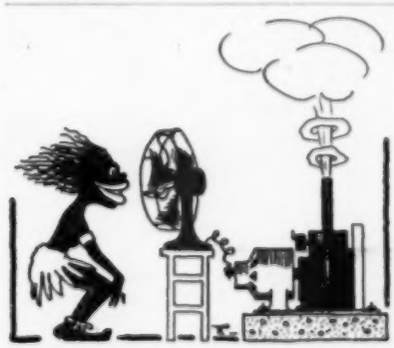
All units should be kept well painted. This includes not only the units themselves, but auxiliaries and floors. Use a good grade of machinery enamel of neutral shade. Also the internal surfaces of the units should be kept well painted with a good grade of white machinery enamel. Figures 1 and 2 show the effect of using such an enamel on keeping the interior of the unit clean. Well painted equipment has a tendency to make the operating personnel more conscious of the necessity of keeping units clean.

In the next issue we will go more into detail on the important points of the annual check up which should be in much greater detail than the periodical short checkups and inspections.

High Speed Diesels

. . . continued from page 60 . . .

The contractor and his superintendent can not be too severely criticized for not doing something to overcome these conditions because they become so accustomed to dealing with dirt that they do not realize the seriousness of having it around. Likewise the mechanics get so used to it that they even tolerate it without too much complaint. It is, nevertheless, very serious. In fact, the writer will venture a statement that in all the years he has been connected with the engine game, dust and dirt right in the engine plants has been a paramount problem. If it is serious in the manufacturing of the engines where all kinds of control are used, it certainly is a bigger problem where engines and other equipment are exposed to uncontrolled conditions. Those of you who are engine manufacturers and you who build the complete equipment can and should do everything you can to help the contractor overcome this problem. Have your service and field managers make up a list of dirt control suggestions and present them to their users. Explain what it will mean to them. It is money in their pockets. New projects are being started every day. Why not include in your equipment proposal a list of suggestions on how to equip his garage to provide the maximum safety for clean repair work. Such helpful suggestions could be included in the contractor's original plans with very little extra expense. Clean working conditions promote better and less costly repairs.



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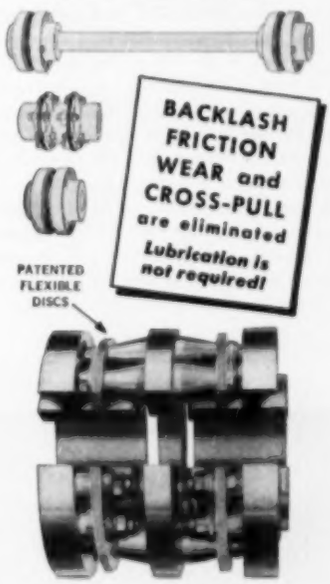

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WHAT'S GOING ON IN ENGLAND

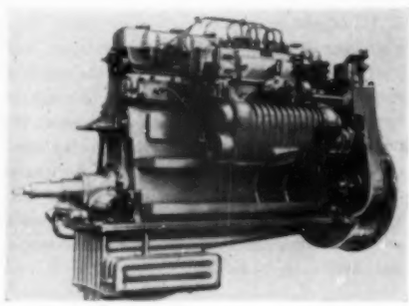
CONDUCTED BY **HAMISH FERGUSON**

Hamish Ferguson was appointed Secretary to the Diesel Engine Users Association in London in 1944. Previously senior technical assistant to Diesel and Insurance Consultants, London, and for several years with English Electric Company in the designing and erection of large diesel generating plants. Mr. Ferguson continues to do independent consulting work.

BRITISH diesels of interest exhibited at the British Automobile and Cycle Show in New York include the following: Russell Newberry and Co. are showing their E.M. 6 marine propulsion unit rated at 120 bhp. at 1,200 rpm., cylinder dimensions 5⅛-inch bore by 7¼ inch stroke. Transmission is through an R.N. fluid-operated reverse reduction gear arranged for wheelhouse control. Also on show is the E.6 engine, developing 100 bhp. at 1,000 rpm., built in to a compact portable unit complete with radiator and accessories designed for use in tropical climates. An original design of Observation Coach is displayed by James Whitson & Co. It is engined by one of the Foden F.D.6 pressure-charged two-stroke units of six cylinders developing 126 bhp. at 2,000 rpm. fitted with Roots-type blower. The proved fuel consumption during chassis tests was under 0.40 lb./bhp. hour equivalent to 15 miles per gallon (Imperial). Maximum speed was 55 mph. and the power weight ratio is only 8.75 lb./bhp.

Associated British Oil Engines display a selection of engines and models representing the products of some of the companies in their group. These include Petter, Meadows and Mirrlees, catering for industrial, marine and automotive applications. Leyland exhibit a comprehensive range of diesel buses and trucks, some especially suitable for British requirements and others designed for export. Of particular interest is the "Olympic" forty seater bus with an underfloor engine, the cylinders being arranged horizontally. Self-loading trucks, dumpers, and a long-distance luxury coach are also shown, in addition to a number of engines for industrial and marine purposes.

William Doxford & Sons Ltd. have handed over to her owners, Moor Line Ltd., a new cargo ship, *Exmoor*, deadweight 9,140 tons. The propelling engine is a four-cylinder opposed-piston Doxford diesel. Harland & Wolff have successfully launched two more diesel tankers, *British Explorer* and *British Consul*, each of 12,300 tons, for the British Tanker Co. Ltd. A sister ship, *British Commander*, has been completed and handed over. The main engine in each case is a Harland-B. & W. single-acting four-stroke diesel, 740 m/m bore by 1,500 m/m stroke at 115 rpm. A further launch was that of the *Suevic*, built for Shaw, Saville and Albion. Though the main propulsion units are steam turbines developing 14,000 shp., this refrigerated ship employs two Harland diesels developing 400 kw. each which are utilized in conjunction with the refrigeration plant.

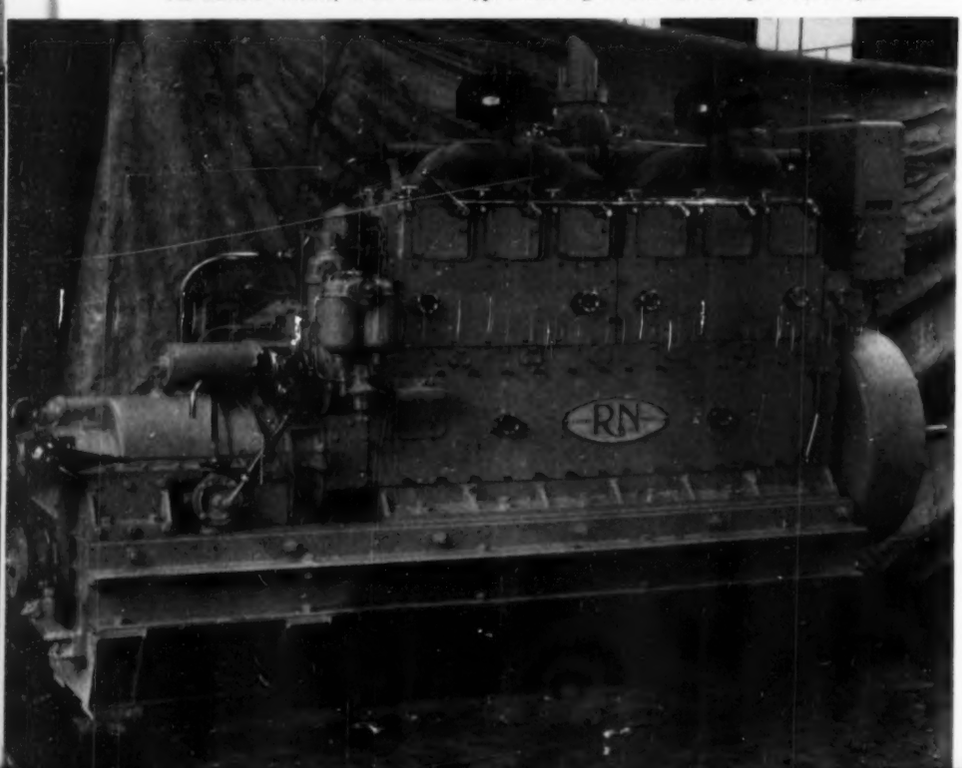


The Foden 6-cylinder diesel engine developing 126 hp. at 2,000 rpm.

"The Yeoman of England" is the name given to a new diesel tractor being manufactured by Turners of Wolverhampton. The power unit is a four-cylinder Turner diesel developing 10 bhp. at 1,500 rpm. It is of the V-type with bore and stroke 3¼x4½ inches. The gear-box provides four forward speeds and one reverse, the maximum speed being 16.7 mph.

During the final stages of World War II, Dutch engineers became acquainted with the diesel shunting locomotives manufactured by the English Electric Co. Ltd. and shipped to Holland to assist the

The Russell Newberry EM-6 Marine type diesel engine rated at 120 hp. at 1,200 rpm.



British Liberation Army. As a result of this the Netherlands State Railways have placed an order for ten locomotives engined with the well-proved 6 KT type of 400 bhp. operating on the diesel-electric system. More than 250 shunting locomotives of this type have already been supplied to British and overseas railways and independent industrial and municipal companies.

Most of the larger film studios generate their own electrical power requirements, using diesels, but for outside work the power had to be obtained

The launching of the *Sueric*.

from the main supply or otherwise contrived. To meet this demand Davey Paxman, of Colchester have developed a mobile generating set which is compact and flexible. The power unit is a Paxman Ricardo 12 RHP V-type, 12-cylinder engine of 350 bhp. driving, through a Wellman-Bibby flexible coupling, a 200 kw. d.c. generator manufactured by the Lancashire Dynamo and Crypto Co. This equipment has played its part in the making of many films which United States readers may have seen, including "Scott of the Antarctic" and "The Fallen Idol."

The Brush Electrical Engineering Co. Ltd., a member of the ABOE group, announce the receipt of an order for 25 diesel-electric locomotives for the Ceylon Government Railways. They will be powered by Mirrlees JVS.12, 12-cylinder pressure-charged V-type engines developing 1,250 bhp., the engines being direct-coupled to Brush 635 kw. generators. It is stated that the value of this order exceeds £1,000,000.

As a result of a recently concluded agreement between the two companies, the well-known Cooper Bessemer two-cycle V-angle gas engine will be manufactured by Harland & Wolff at their Belfast works. It is understood that a number of orders for this engine have already been accepted.

Thermometer Catalog

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Supervising and Operating

. . . continued from page 62 . . .

spected often and taken care of they serve a vital need, but it is folly to install them, forget them, and expect them to be johnny on the spot in case of trouble.

Many such pieces of equipment are placed in special wells for the tube bulbs. Often they become corroded and encrusted with rust and slime which acts as an insulator and does not allow the alarm to function at the maximum temperature or pressure. Bulbs sometimes break off the tubes, making the alarm ineffective. Another item is the corroding of pyrometer bulbs in the exhaust headers. These must be cleaned and inspected occasionally if you expect the proper exhaust temperatures to be recorded.

Many more safety measures could be mentioned, but safety and safety practices depend largely on the alertness and cooperation of the plant personnel. Any plant that follows a rigid inspection system and augments it with the operating and maintenance program will have little difficulty in keeping an excellent safety record.

Diesel Engine Catalog now available in its Fourteenth Edition. See the unique Diesel Horsepower Range Chart — invaluable aid to design engineers and buyers. ORDER COUPON ON PAGE 89.

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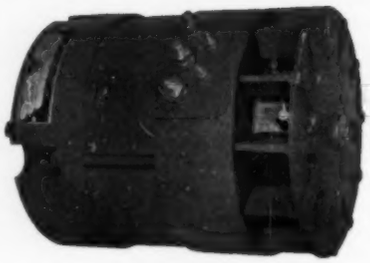

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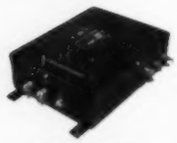

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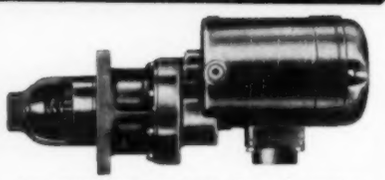

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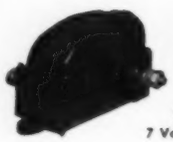

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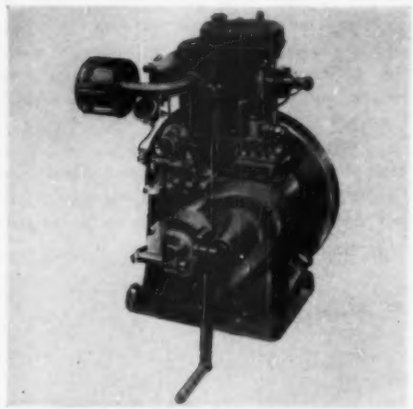

The Crofton Diesel Engine Company of San Diego has a new, improved low horsepower diesel engine on the market that is rated at 5 hp. at 1,500 rpm. This self-contained, air-cooled diesel is designed for every kind of power duty and is cold starting.

The 1950 Crofton line shows that the new improved 5/1 diesel has the same combustion chamber and fuel system, but is lighter and more enclosed. Equipment includes Twin-Disc take-off clutch, Auto-Lite starting, Bosch fuel injection, and regulated lube oil system incorporating a pressure gauge on the engine. The original 10/2 horsepower models of last year are rated at 10 hp. at 1,500 rpm., but Crofton has on test its new one-cylinder 10/12 hp. diesel that is lighter, more enclosed, which will replace the present 10/2 in June, 1950.

The Crofton Company feels the time has arrived when the users' cost for a small industrial diesel engine must approach the present day gasoline engine prices. Crofton's entire line is being engineered along these thoughts. Thus the lighter, compact diesel engine designs in all their models up to 15 hp. are along this price direction.

Booklet on Distilled Water

Barnstead Still & Sterilizer Co., Inc., has issued a new comprehensive catalog which describes in detail the difference between distilled and demineralized water. This 20-page catalog highlights the advantages of either distilled water or demineralized water as used in manufacturing and processing operations which call for pure water. It answers the question: "What is the difference between distilled and demineralized water?" It also cites case histories on quality control of water that has resulted in better products, uniform results, fewer rejects, and the reduction of costs in plant operations. It shows how ion-exchange purification works with the catalog containing more than 30 illustrations. The manufacturer offers to send Catalog 123 to anyone interested in pure water and states that the Barnstead Engineering Department will be glad to make recommendations on equipment for special applications. Write Barnstead Still & Sterilizer Co., 196 Lanesville Terrace, Forest Hills, Boston 31, Mass.

Don't forget the meeting at Baltimore, Oil & Gas Power Division of A.S.M.E., June 12-16.

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Bulling around in a logging camp subjects Diesels to flying dirt, dust, sawdust, and other engine-wrecking abrasives. They creep into the oil stream day in and day out . . . and unless they're filtered out in a hurry—watch the repair bills and layup time pile up!

Here—as under any rugged operating conditions—rely on Purolator Micronic Oil Filters for a complete filtering job!*

Why? Because Purolator's exclusive Micronic* element traps abrasives measured in microns (.000039 of an inch) . . . has a revolutionary accordion-pleated design which provides a filtering area up to 10 times that of old-style oil filters.

For fuel oil filtration, this means the complete job so vital because of close tolerances of injector plungers, and the microscopic size of injector tip orifices. And for lube oil filtration, Purolator's greater efficiency assures less wear on hard-working bearings and other vital parts.

We know that Purolators can solve your filtering problem. Let our engineering staff show you how! *Reg. U. S. Pat. Off.

PUROLATOR PRODUCTS INC.

Rahway, New Jersey; and Toronto, Ontario, Canada

Protect your Power with Purolator!

PUROLATOR
MICRONIC OIL FILTER
"FIRST IN THE FIELD OF FILTERING"

Alco Appointments

Appointment of William G. Miller as executive assistant to the Chairman and President of American Locomotive Company was announced by Duncan W. Fraser, Chairman and President. Since August, 1948, Mr. Miller has been manager of the company's Auburn, New York, plant. He is succeeded at Auburn by Charles T. Lathrop, formerly Auburn Works manager. Mr. Miller joined the Alco Products Division of American Locomotive at New York in 1932 as a project engineer. In 1937 he was sent to France to direct the construction of the Anglo-Iranian Oil Company. In 1939 he returned to New York. Transferred to the staff of the vice president in charge of manufacturing in 1940, Mr. Miller took charge of coordinating the company's operations with government defense and war production regulations and directives.

In October, 1945, he became superintendent of the Diesel Locomotive Division in Schenectady, N. Y., as Alco began manufacture of its current line of modern diesel-electric locomotives. Mr. Miller was appointed assistant to the manager of the Auburn plant in February, 1948, and six months later became manager. He was graduated from Stevens Institute of Technology, Hoboken, N. J., in 1927.

Diesel Engine Catalog now available in its Fourteenth Edition. See the unique Diesel Horsepower Range Chart — invaluable aid to design engineers and buyers. ORDER COUPON ON PAGE 89.

Thermostat to Control Engine Water Cooling

The American Motor Company has on the market a new thermostat to control engine cooling water temperature automatically by mixing cooled and recirculated water together. It is a by-pass type of regulator and therefore places no restriction on the water pump. This thermostat is self contained and requires no adjustment as it is set permanently at the factory. The "Amot" thermostat was designed for large diesel engines, gasoline engines and natural gas engines.

The 2-inch thermostat has 2-inch pipe connections and is suitable for heavy duty engines with piping from 1¼ inches up to 2 inches or larger. A single thermostat will handle engines from 100 hp. to approximately 450 hp. For larger engines two thermostats in parallel are used. In this manner engines up to 1,000 hp. turbocharged can be handled. For stationary and industrial installations, the larger of the three sizes is normally used, as it will maintain the engine at its most efficient temperature of 160-165 degrees F.

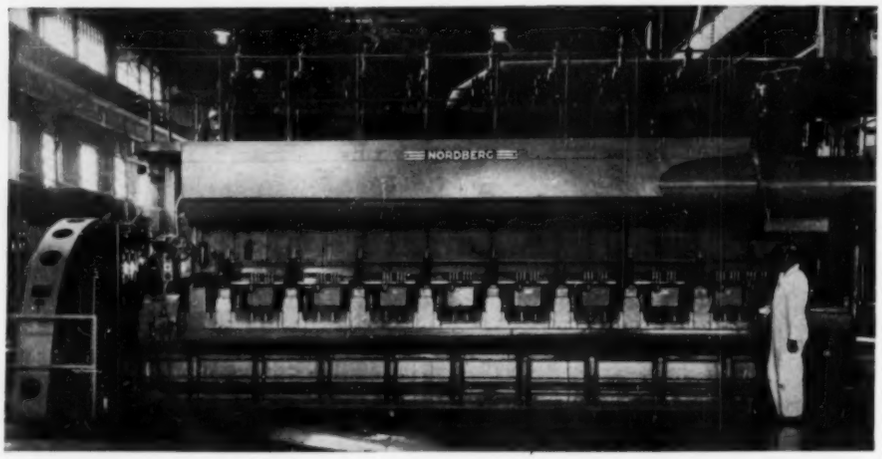
New Multipurpose Grease

After more than a year of laboratory and road tests, Sinclair Refining Company is placing on the market a multi-purpose grease to be known as Sinclair Litholine. Replacing the many types of greases required in the past, Litholine will increase the efficiency of greasing establishments of commercial truck and bus fleet operators as well as operators of contracting equipment. The utilization of Litholine as the sole lubricant will permit of the use of one grease and one grease gun for the entire job, eliminating the danger of misapplication through use of the wrong grease. In addition the operator will be able to serve a larger number of vehicles in a shorter period of time, securing maximum efficiency from all lifts, ramps or stalls available.

Made from a combination of lithium base soap and a highly refined mineral oil, Litholine provides greater lubricating qualities than greases formerly on the market. Performance reports indicate longer life of the grease, higher resistance to heat and cold, superior water resistance and greater protection against rusting. Litholine will be available through Sinclair dealers and distributors in its marketing territory April 1.

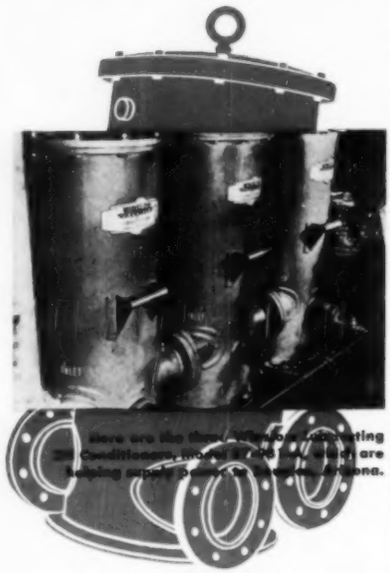
Bulletin on Fuel Oil Treatment

E. F. Drew & Co., Inc., has anounced the availability of a technical folder on fuel oil treatment and sludge removing. This folder describes the means of preventing or correcting unsatisfactory conditions in the storing, handling, pumping, heating and burning of industrial fuel oil. Copies are available from Power Chemicals Division, E. F. Drew & Co., Inc., 15 East 26th Street, New York 10, New York.



WINSLOW FILTERS PROTECT GIANT DIESEL IN ARIZONA POWER PLANT

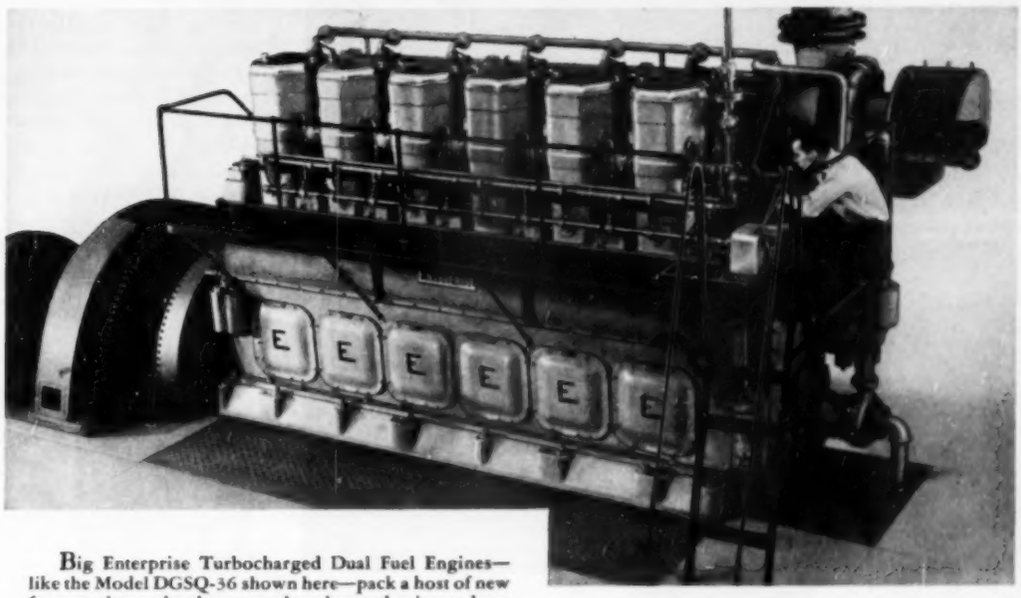
Arizona's desert is the delight of thousands of tourists. But the desert means sand, and sand is a menace to huge Diesels such as the mighty Nordberg with which the Arizona Edison Company supplies power to Douglas. Sand and sulphur and other substances in the lubricating oil had meant several costly replacements of bearings and liners before Winslow Filters were installed. Months later, after more than 3,000 hours of operation, Superintendent Carl W. Nelson reported: "The oil is still in perfect condition." For equal safety and performance, ask us for complete information.



WINSLOW FILTERS

503-H-1 **Winslow Engineering Company** **4069 Hollis Street • Oakland 8, California**

THERE'S NEW ECONOMY IN ENTERPRISE TURBOCHARGED *DUAL FUEL ENGINES*



Big Enterprise Turbocharged Dual Fuel Engines—like the Model DGSQ-36 shown here—pack a host of new features that make them your best buy today in modern, high-economy power.

Here is the engine that actually cuts operating costs as much as 50%. For in addition to the economies inherent in Enterprise straight diesel operation, this flexible engine efficiently handles a variety of gas fuels, including natural gas, butane or butane-propane mixtures, manufactured or sewage gas—whichever is available at lowest cost per BTU. The new Enterprise gas-fuel system is quickly set or changed to any mixture desired—without stopping the engine or changing parts—from full diesel operation to 95% gas, 5% pilot oil. No dangerous overloads are possible. And Enterprise Turbocharging further reduces initial engine costs per HP, plus gaining important savings in fuel.

When you compare—feature for feature—*your* choice will be Enterprise . . . the choice of power experts.

Write for new Bulletin ▶

Bulletin No. DF-200 describes in detail the outstanding features of Enterprise Dual Fuel Engines, normally aspirated and turbocharged. Write for your copy today!

ENTERPRISE ENGINES

ENTERPRISE ENGINE & FOUNDRY COMPANY

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OFFICES IN PRINCIPAL CITIES

Selecting Large Motors for Oil Pumping Service

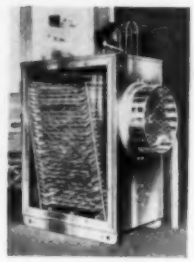
How to select large motors for pumping service in the oil industry is the feature article in the Oil Industry Number of the E-M Synchronizer. Other articles include Insulation Requirements, Safety of Motor Controls, Electric Power Generation for Oil Field Use, Electric Power Generation in Field Processing Plants in Compressor Stations. Also this two-color, 24-page issue describes the recently installed Basin Ozark Pipe Line. Copies gladly sent on request by Electric Machinery Manufacturing Company, Minneapolis 13, Minnesota. Ask for your copy of Synchronizer No. 30.

Oil Rig Operates Three Years Without Engine Overhaul

A submersible barge diesel-electric oil well drilling rig has recently completed more than 18,000 hours operation without a major engine overhaul. This unusual record was obtained, it is reported, as a result of the use of the General Electric control system, which provides an "infinite ratio gear-shift" by means of an electro-hydraulic governor and control system. This equipment provides for matching speed to the load requirement and also prevents engine overloads occurring. Placed in initial operation in Texas about three years ago by a major oil company, the rig has been using G-E electric drive and associated control. During this long service, maintenance has been kept to a minimum because engine overload, one of the principal causes of engine failure, has been removed through the use of the General Electric electro-hydraulic governor to control the diesel engine which drives the electric generator.

Since a drilling load is both intermittent and varying, it is highly desirable to operate the engines at the lowest speed consistent with power requirements. Through the use of the electro-hydraulic governor, desirable engine speed is maintained by the driller at a remote location with simple controls. It is said that both the reduction in speed as well as the elimination of overloads account for the extraordinary time without engine overhaul. A simple switching arrangement at the driller's control station permits parallel operation of several engine generators for operation of the draw works. This is accomplished without any mechanical clutches or other wearing parts. In addition, the governor permits the use of maximum torque of the drilling motors at all speeds within the ability of the engines. In effect, this permits the "trading" of speed for torque through a continuously adjustable choice of ratios between the engine and the load.

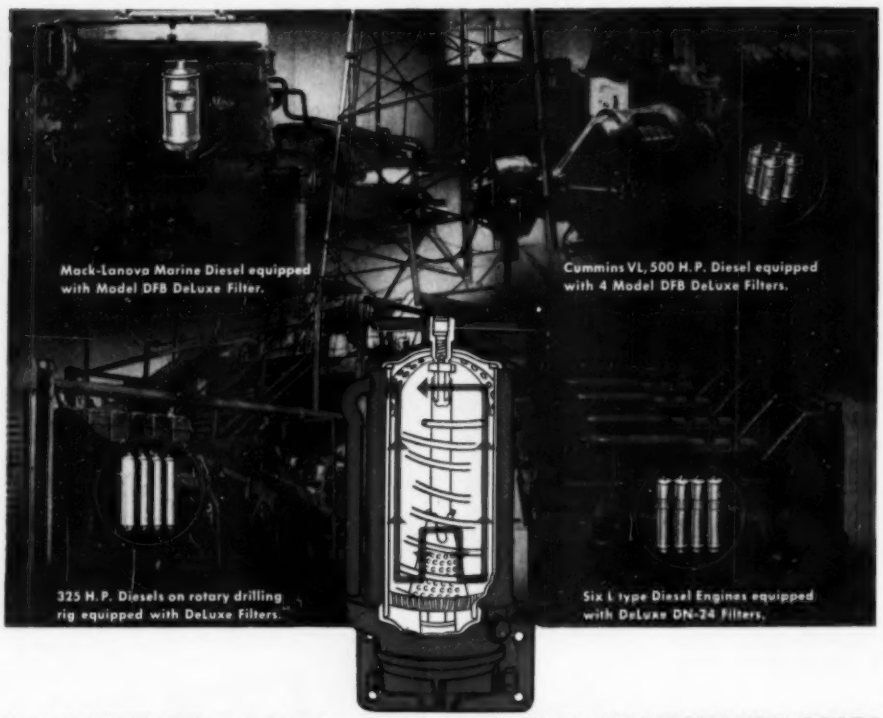
New Type Water Cooling Tower



The Marley Company, Inc., manufacturers of water cooling towers, nozzles, and DriCoolers, anounces that the new 1950 Aquatower line will have an additional size plus improvements on all models. A 20-ton Aquatower will be available to meet the increasing demand for this size unit. Interiors of all towers will be lined with a thick coating of rubber to make the interior of the tower impervious to corrosion. A new quiet, deep pitch fan is used which operates at one-half the usual speed. The rubber lining plus the slow speed fan gives unusually quiet operation. Aquatowers are a packaged product, completely assembled, ready to go. They are sized from 3 to 50 tons. Aquatowers still have the open distribution basin, redwood filling from top to bottom, totally enclosed motors and complete basin fixtures. They are carried in stock in many principal cities or are available for immediate shipment from any of the four Marley Factories. Request Bulletin AQ-50.

How Thick Is .0045?

It makes a mighty big difference to the Standard Oil Company of California. Through a typographical error, their March advertisement in DIESEL PROGRESS stated that after one-half million miles of use when RPM Delo Oil R.R. was used, a locomotive Diesel cylinder miked .005 out of round. Actually the copy should have read only .0005—one-tenth as much, and extremely small for one-half million miles of wear. Check back on the advertisement—it's a very interesting story.


Mack-Lanova Marine Diesel equipped with Model DFB DeLuxe Filter.
Cummins VL, 500 H.P. Diesel equipped with 4 Model DFB DeLuxe Filters.
325 H.P. Diesels on rotary drilling rig equipped with DeLuxe Filters.
Six L type Diesel Engines equipped with DeLuxe DN-24 Filters.

Get LONGER Diesel Engine LIFE and LOWER MAINTENANCE COSTS

with DELUXE FULL-DEPTH Filtration!

Longer Oil Travel is the Secret of DeLuxe's Thorough Oil Cleansing Principle!

Operators of mobile and stationary diesel engines have enjoyed the benefits of DeLuxe's Full-Depth Filtration Action for over 15 years. The Full-Depth Principle is so basically sound, so simple, that once pointed out it is easy to appreciate the reasons for DeLuxe's outstanding performance.

LONG OIL TRAVEL from *bottom to top*—the entire length of the filter, instead of the conventional *center to side* SHORT OIL TRAVEL is essential to thorough oil cleansing. With every DeLuxe Filter you get FULL-DEPTH FILTRATION *plus* these 3 exclusive DeLuxe Advantages:

1. A patented Spring built into the cartridge that assures uniform density—prevents cartridge collapse under engine pressures.
2. The exclusive metal Cone that insures correct, uniform rate of oil flow—drops heavy particles into the sump.
3. The new, removable Sedisump that collects dirt, water and sludge—makes sump cleaning quick, easy and clean.

Proof that the DeLuxe Principle of Full-Depth Filtration actually does the job *right* is the fact that year after year, 75% to 90% of the Winners of Bus Transportation Maintenance Awards go to DeLuxe users. Last year 15 out of 18 Award Winners were DeLuxe Equipped.

For valuable information on the care and maintenance of all filter-equipped engines, write for your free copy of the "Key to Clean Lubrication".

DELUXE PRODUCTS CORP. 1416 Lake Street, LaPorte, Indiana

DELUXE Oil Filter

DOES MORE THAN STRAIN OIL... MORE THAN FILTER OIL

ACTUALLY CLEANSES OIL

R-5039

*UNIFORMITY

Under all conditions the proved performance of Tycol lubricants more than meets their recommended service.

Rigidly controlled and tested during manufacture . . . and refined from the highest grade crudes, Tycol oils and greases are known for their *UNIFORMITY within each classification — from the first drum to the last.

This unvarying high quality, plus the scope of the line, accounts for Tycol's wide acceptance by industry interested in maximum production . . . top efficiency . . . lowest operating cost.

Whatever your lubrication need, let a Tide Water Associated engineer help you select the one suited for your particular need. Call, write or wire your nearest Tide Water Associated office for full details.

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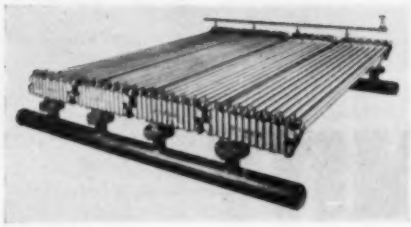
*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA"
This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL — THE WORLD'S MOST FAMOUS MOTOR OIL

New Bulletin Offer

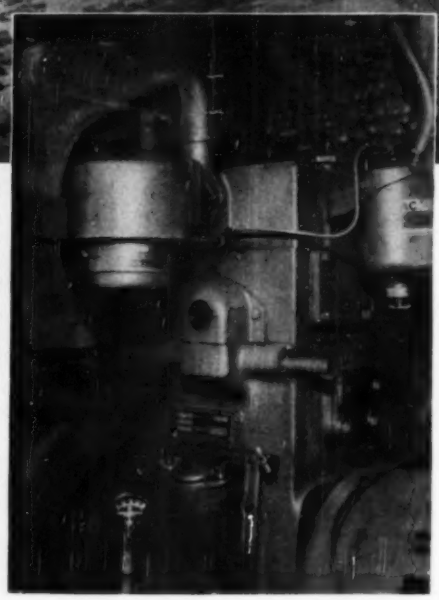


Binks Manufacturing Company has recently announced the publication of bulletin 41, Bink's Type "D" Evaporative Heat Exchange Coils. These coils are utilized singly or in multiples to provide a closed type cooling system for numerous applications, handling a variety of liquids. They are popular for cooling diesel and gasoline engine jacket water and similar applications. Binks water cooling engineers claim especially good temperature performance from Type "D" Coils, because (1) the spraying process cools the raw water in advance of its contact with the hot tube surfaces; (2) greater ratios of raw water to liquid being cooled can be used; (3) regulation of either raw water or liquid flow permits exact temperature control; (4) cooling of the coils is effected by both "evaporation" and "convection," giving increased heat transfer efficiency; (5) scale formation on the tubes is greatly reduced. Any scale that does form is broken free by the expansion and contraction of the tubes with changes in temperature; (6) a 3-pass arrangement in the standard Binks heat exchange coils gives increased velocity of liquid through the tubes and hence greater cooling efficiency.

SPEED-UP ON THE SANTA FE:

Here's the beginning of a new era in radiophone communication, as developed by a famous railroad outstanding for its widespread adaptation of diesel power. Through freights on three of its California divisions are handled faster, safer, through communication between cabooses and locomotives, from trains to yards. At one yard alone, radio calls averaged 45 in 24 hours. Equally as important, locomotives, cabooses, yards, stations, all can "listen in."

It takes dependable, economical auxiliary power to meet the rigid requirements of railroading—power such as furnished for the Santa Fe cabooses by Lister-Blackstone Diesels.



115 volt A.C. current is provided by 2.5 K.V.A. alternator direct-connected to the engine.

NEW REDUCED PRICES

GIVE YOU TODAY'S BEST DIESEL VALUE FOR YOUR DOLLAR

Write us your requirements. Address Dept. DP.

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THE LONG-LASTING DIESEL

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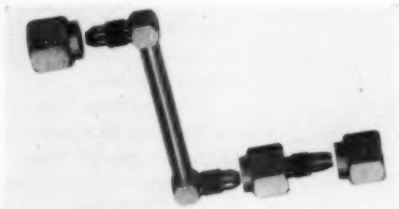
Sold and Serviced in 37 Countries Throughout the World

A Versatile Nozzle Tester

DIESEL fuel injection nozzles, because of the severe conditions to which they are subjected in service, require inspection and maintenance at regular intervals. It is therefore important that those responsible for the operation and maintenance of diesel engines be equipped to observe the performance of fuel injection nozzles outside of the engine, quickly, conveniently and accurately. This is a protective measure which not only prolongs

This nozzle tester can be quickly and easily adapted for testing injection equipment for 235 models of diesel engines.

the life of fuel injection equipment itself but also has a direct bearing on overall engine efficiency and life. Such testing equipment should enable the diesel mechanic accurately and easily to check the nozzle opening pressure and to determine whether re-adjustment is necessary, also to make sure that all spray tip holes are open and that the spray pattern is symmetrical and to test both the nozzles and nozzle holders for dribble and leaks at critical points. It is of paramount importance that the equipment for making these tests be readily adaptable to a wide variety of nozzles, also that



The connector tube served as support for various types of nozzles when fitted with the proper adapter nuts.

it be available for use in the field as well as in the shop. The heart of the nozzle tester is the test pump which, in this case, is designed to eliminate "air troubles" and is fitted with a chrome steel plunger, hardened and lapped into the pump body to assure leak-proof operation. This is, however, a more or less standardized unit which is available, with certain modifications, through a number of sources. But unless the test pump is equipped with a variety of adaptors, it is conceivable that a separate pump for each type of injection equipment would be required in shops where a number of different makes of diesels are being serviced.

For the nozzle tester illustrated here a greatly simplified connector set has been developed, containing all parts needed for testing the injection nozzles used on 235 different makes and models of diesel engines. One and the same connector tube serves as a support for all nozzles and this tube is designed to place all nozzles with side fuel inlet in upright position with the spray tip above the surface on which the tester is mounted so that the fuel spray may be caught in a glass jar placed under the nozzle. This vertical positioning of the nozzle also facilitates observation of the spray pattern. Connection of various types and sizes of nozzles to the connector tube is accomplished by interchangeable nuts having two-way threads. One end of the nut has right-hand threads matching the fuel inlet threads of the nozzle to be tested and the other end of the nut has left-hand threads matching the threads on the connector tube. Attachments of the nozzle merely involves starting the right and left-hand threads simultaneously and turning the nut clockwise until the connection is tight. The connector tube is fitted with a 60-degree cone end which is quite common on diesel fuel lines, but the outfit also includes an adapter

. . . and now please turn to page 77 . . .

are you SUBTRACTING the additives from your diesel lube oil?

The Sharples Oil Purifier removes only carbon sludge, abrasives, scale, and water. IT DOES NOT REMOVE OR HARM THE IMPORTANT ADDITIVES IN YOUR LUBE OIL.

Diesel lube oil is a highly developed, complex product today. Many additives have been incorporated in these oils for good reason: to protect the cylinder linings, bearings, and piston rings of your diesel engine from wear and corrosion. Detergent oils contain additives which keep the carbon in suspension and avoid deposits on the rings. Modern diesel engines are built to operate with these "detergent" oils, and if the additives which form the characteristics of the oil are removed in the purifying operation, the result is increased cylinder liner and bearing wear, sticking piston rings, and general maintenance problems which result from the use of an improper lubricant.

The Sharples Oil Purifier removes all harmful substances without removing or in any way inhibiting the action of any additives in the oil.

Therefore, you are assured of safe, clean oil which may be used and re-used many times; all of the properties of the oil are maintained after purification—none are strained or filtered out.

You save every way with a Sharples Oil Purifier: continuous engine efficiency, longer oil life, lower maintenance costs, and less down-time for repairs.

Call Sharples today for the complete, simple facts.

A centrifugal force 13,200 times the force of gravity purifies oil without filters. The Sharples Oil Purifier is a complete unit including pump and motor assembly.

Sharples Diesel Oil (Lube & Fuel) Purifiers

PURITY WITHOUT REMOVING THE ADDITIVES

THE SHARPLES CORPORATION

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ASSOCIATED COMPANIES AND REPRESENTATIVES THROUGHOUT THE WORLD

Profitable Pipelaying

Pipeline construction with the giant new International TD-24 and other industrial tractors of the 12-model International line, is featured in an attractive new two-color mailing folder issued by International Harvester Company. "International Power for Profitable Pipelaying" offers an interesting roundup of on-the-job action shots from spreads throughout the country, with owner and operator performance reports included in many of the photocaptions. Diesel and gasoline, crawler and wheel models are shown in typical pipelaying operations. Brief copy describes exclusive International design, construction and operating features for cutting costs from clearing to clean up.

RN

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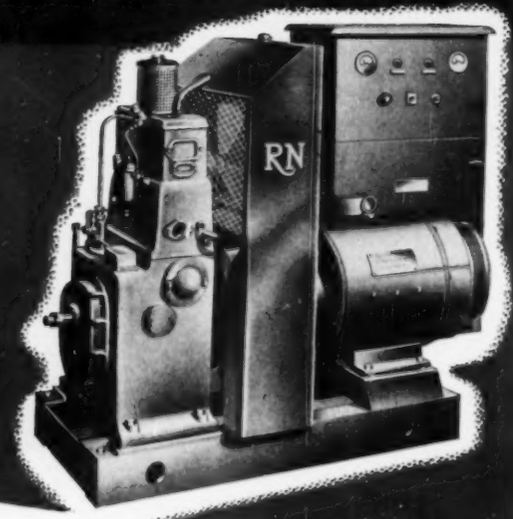
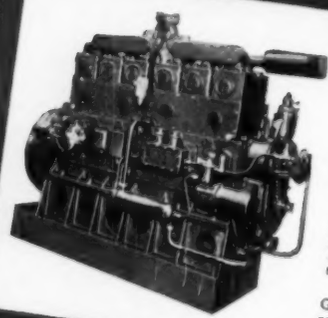
Auto-Light

ALL THE ADVANTAGES OF MAINS ELECTRICITY!





RN DIESEL ENGINES

INDUSTRIAL

9 models 1–6 cylinders, 5/150 h.p. at 600/1000 r.p.m.
4 models 1–4 cylinders, 13/52 h.p. at 1500 r.p.m. (B.E.S.A. ratings).
60-cycle A.C. or D.C. Generator Sets up to 95 kW.

MARINE PROPULSION

8 models 2–6 cylinders, 18/150 h.p. at 1000 r.p.m.
4 models 2–4 cylinders, 22/48 h.p. at 1200 r.p.m.
3 models 2–4 cylinders, 27/52 h.p. at 1500 r.p.m. (B.E.S.A. ratings).

MARINE AUXILIARY

Generator, Pump and Compressor Sets for Shipboard use—range as Industrial.

APPLICATIONS INVITED from firms in the U.S.A. interested in the possible distribution of our range of diesel engines. Stock and Credit Facilities available.

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ESSEX WORKS, DAGENHAM, ESSEX, ENGLAND. Cables : Diesel, Dagenham.

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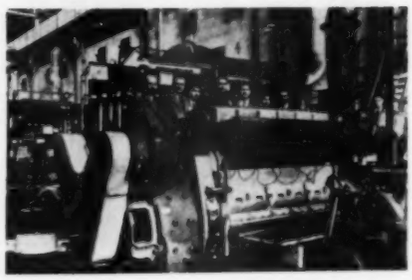
COLOMBIA—IGNACIO GOMEZ Y CIA., BOGOTA

Diesel Educational Symposium



The Hamilton, Ohio, plant of the Lima-Hamilton Corporation was host recently to another diesel engine educational symposium, sponsored by the Diesel Engine Manufacturers Association. A total of twenty-two professors and instructors concerned with teaching internal combustion engineering at 12 colleges and universities attended the all day session. The Roots-Connersville Blower Corp. shared with Lima-Hamilton in the presentation of technical papers covering topics in the internal combustion engine field.

After an inspection tour of the shops of Niles Tool Works, and Hooven, Owens, Rentschler Company, two separate divisions of Lima-Hamilton Corp., Walter A. Rentschler, executive vice president of Lima-Hamilton, presided over the morning meeting. Papers were presented on the Lima-Hamilton pressured charged 4-cycle 9x12-inch diesel switcher engine, the free-piston gasifier-gas turbine plant, and the instrumentation of a free piston gasifier-gas turbine testing laboratory. Before afternoon sessions, guests inspected the internal combustion engine laboratories and observed a free piston gasifier-gas turbine plant in operation. John Avery, president of Roots-Connersville Blower Corporation, presided during the afternoon, when papers were given by Roots-Connersville representatives on positive displacement blowers, centrifugal blowers, and the Rotham internal compression high pressure blower.

General Chairman at Diesel Meeting

Jack A. Nelson

Jack A. Nelson, of Chicago, diesel engineer with Standard Oil Company (Indiana), has been appointed general chairman for the national diesel engine meeting of the Society of Automotive Engineers, Inc., at the Hotel Knickerbocker in Chicago November 2 and 3, 1950. Mr. Nelson joined Standard Oil Company (Indiana) in 1937, as an automotive engineer in the Des Moines, Iowa, sales field, and in 1942 became a diesel engineer in the sales technical service department of the general office at Chicago. He has attended Standard's sales engineering school as well as a number of engine manufacturers' service schools. Author of "Industrial Diesel Engines" and several other papers on diesel lubrication, Mr. Nelson has done pioneer work in the use of heavy-duty type oils in large industrial diesel engines.

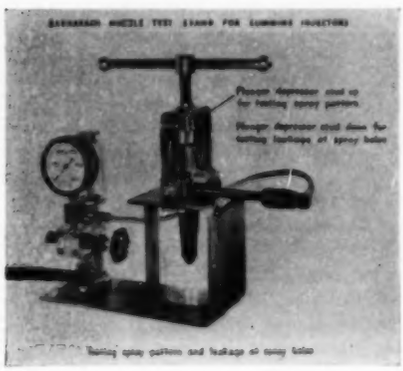
. . . continued from page 75 . . .

Checking opening pressure of injector check valve and

stud by means of which the connector tube may readily be adapted to Ermeto type fittings. The connector set consists of only eight small parts which fit in spring clips on a steel display plate which is marked with the same identification number that is stamped on each piece. A simple chart has been worked out showing the connector parts by numbers to be used for testing nozzles used on various models of engines built by Buda, Caterpillar, Climax, Continental, Fairbanks-Morse, Hallett, Harnischfeger, Hercules, International, Kermath, Lathrop, Lorimer, Mack, Palmer, Superior, Waukesha and Waukesha-Hesselman. The basic test stand is the same for all the foregoing engines. The simple connector set takes care of the variations in injection equipment.

Illustrated here are the arrangements for testing Cummins and General Motors 71 injectors. In these cases, although a special arrangement of the test stand is required, it is interesting to note that these same stands may be quickly adapted for testing any of the 235 makes and models mentioned above by simply disconnecting the tubing from the fuel discharge nipple of the tester and then connecting the nozzle to be tested by means of the connector tube and nuts supplied in the connector set.

The nozzle tester stands only 9 inches high and weighs only 6½ pounds with the gauge. The entire outfit, including nozzle tester, connector set and a nozzle cleaning kit, packs in a compact carrying case for the convenience of factory engineers and dealers service men in making field tests.



Testing spray pattern and leakage at spray tubes

Diesel Engine Catalog now available in its Fourteenth Edition. See the unique Diesel Horsepower Range Chart — invaluable aid to design engineers and buyers. ORDER COUPON ON PAGE 89.

You'll get better filtering at lower cost . . .

with NUGENT NUPACK Graduated Density Oil Filter Recharges

Genuine Nugent Nupack replacement cartridges assure you of the dependable, troublefree service which your Nugent filters were built to give. Comparative tests of genuine Nugent recharges and imitations have proven that Nugent recharges last up to twice as long and absorb up to eight times the carbon, grit, etc., providing cleaner, safer fuel or lube oil all the time.

Nugent Nupack Recharges are cellulose filter elements, graduated in density so that dirty oil passes through progressively finer fiber structures until at the center of the recharge, dirt and carbon particles as small as a few microns are removed. Uniform dirt loading means maximum life and maximum efficiency from the unit.

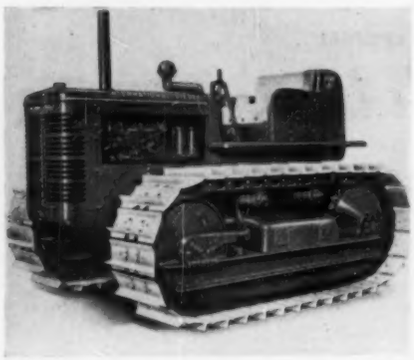
Nugent Nupack Recharges are sized to fit existing Nugent filter shells. For complete information and prices send us the figure number and sizes of your Nugent Filters.

Wm. W. Nugent & Co., Inc.
415 N. Hermitage Ave. CHICAGO 22, ILLINOIS

Established 1897

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS
Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

More Powerful International TD-9



Higher power-performance ratings for the International TD-9 diesel crawler tractor, resulting from new design changes in the "9" series four-cylinder engine, are announced by International Harvester Company. Work capacity of the crawler has been increased through engine improvements which provide more horsepower at the flywheel and drawbar. The TD-9 now in production has drawbar horsepower of 40.5, compared to 38.88 in the previous model.

Greater engine power has been obtained through a redesigned combustion system featuring new pistons, an improved precombustion chamber, simplified injection nozzles, the new "A" model IH fuel pump and a higher compression ratio, 15.7:1 as compared to 14.4:1. In addition, the engine now has a counterbalanced crankshaft and new connecting rods, for smoother operation and longer service life of parts. Complete specifications on the increased-horsepower TD-9 are available from International Harvester Company, 180 N. Michigan Avenue, Chicago 1, and I. H. District Offices and Industrial Power distributors.

New Bulletins by Standard Pressed Steel

The Standard Pressed Steel Company of Jenkintown, Pa., has announced the publishing of two new bulletins, 701 and 715. The bulletin 715 describes the "Carry-Tool" as the latest addition to their Hallowell Shop Equipment line. The "Carry-Tool" is a sturdy, easy-rolling, step-saving carrier in the shop, on assembly lines, at machines or in the tool room. Bulletin 701 contains full information and illustrations as to construction and general information, how to order, sizes, models, and catalog numbers of Hallowell Work Benches.

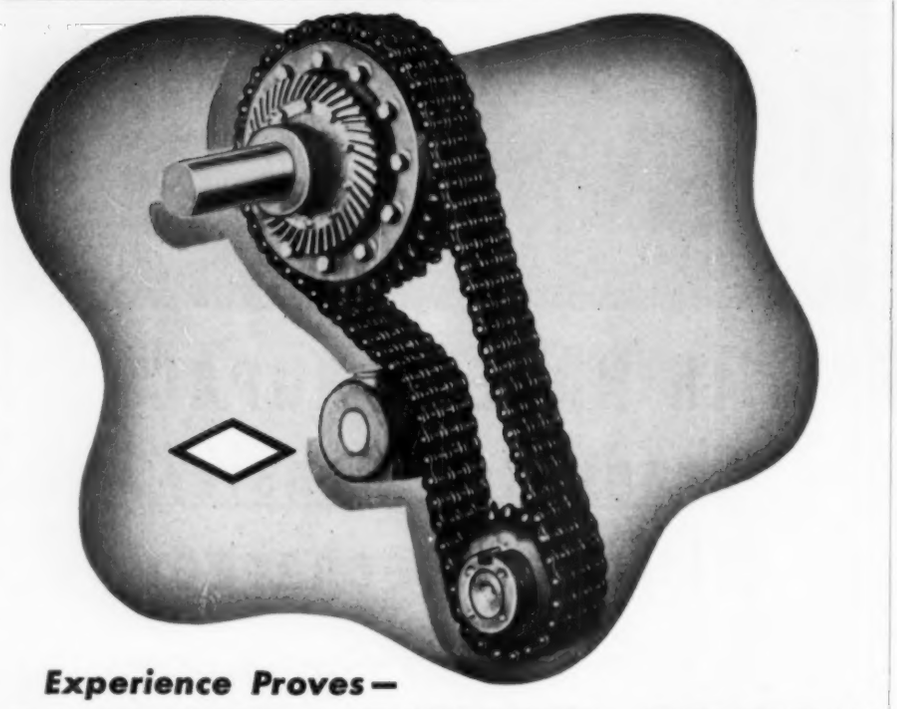
New Factory for Caterpillar

T. R. Farley

Caterpillar Tractor Company announces that it has acquired approximately 300 acres of unimproved land near Joliet, Illinois, on which it will immediately start construction of a new factory in which will be manufactured a large portion of the company's extensive line of bulldozers, scrapers, wagons and rippers. The new plant at Joliet marks an additional expansion of manufacturing facilities with which it is planned to achieve the greatest possible economy in the manufacture and distribution of Caterpillar products. In addition to its main plant at Peoria, Illinois, Caterpillar has a factory and parts depot at San Leandro, California, and parts depot at Kansas City, Kansas; Atlanta, Georgia; Shreveport, Louisiana; Albany, New York; Minneapolis, Minnesota; Spokane, Washington; and Indianapolis, Indiana.

American Bosch School

The American Bosch Corporation is going to hold another of their very popular schools for college and university professors during the week of June 19, 1950, and the following professors have filed reservations: R. L. Allen, Georgia Institute of Technology; Jerome Bartels, Polytechnic Institute of Brooklyn; Jerome P. Berliner, University of Pennsylvania; Lewis D. Conta, The University of Rochester; David P. Flitner, Pratt Institute; Clarence Groth, Polytechnic Institute of Brooklyn; Michael Guidon, University of Washington; Wm. H. Kite, North Carolina State College; Walter Mathias, Union College; Robert L. Stanley, The Pennsylvania State College; Karl W. Stinson, Ohio State University; H. J. Thomiszer, Illinois Institute of Technology.



Experience Proves—

DIAMOND TIMING DRIVES

REDUCE "DOWN" TIME

The simplicity of Diamond Chain engine applications as well as their long-life reliability have been extensively proven on thousands of Diesel engines designed and built under the supervision of leading engine designers during the past 30 years.

Unlike gears, if replacement ever becomes necessary, no major dismantling is required to put on a new Diamond Roller Chain Drive . . . The expense is much less, and very little time is required.

The Diamond specialized engineering staff is ready to place its experience at your command. Call on them for practical recommendations now. DIAMOND CHAIN COMPANY, Inc., Dept. 407, 402 Kentucky Avenue, Indianapolis 7, Indiana.

Ask for Diamond Diesel Drive Booklet

DIAMOND ROLLER CHAINS

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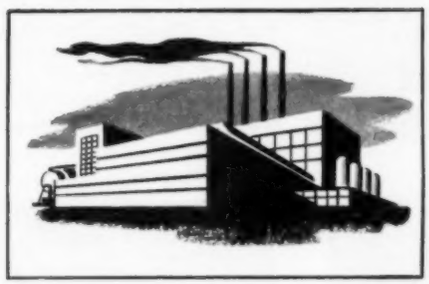
Bendix-Skinner

ORIGINATOR OF **MICRONIC** FILTRATION

the *Finest*

Way to Make Liquids Come Clean



Nine times out of ten ***Bendix-Skinner*** filters will supply the "finest" answer to your problem. No magic—just the simple fact that ***Bendix-Skinner*** has developed entirely new and exclusive filtering techniques in twenty years of tackling the tough jobs. We'll welcome an opportunity to prove it. An inquiry costs you nothing and may save you much.

Over 350 Models *providing filtration from ½ micron (.000019") upwards at flow rates from 1 to 5000 g.p.m.*

SKINNER PURIFIERS DIVISION OF

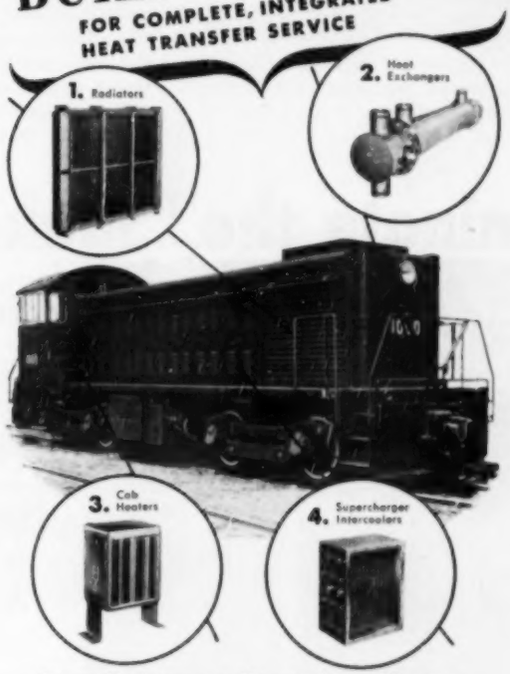
1500 TROMBLY AVENUE
DETROIT 11, MICHIGAN

Bendix aviation corporation

Export Sales: Bendix International Division, 72 Fifth Ave., N. Y. 11, N. Y.

YOUNG.....
BUILDS ALL FOUR

FOR COMPLETE, INTEGRATED HEAT TRANSFER SERVICE



Young Engineers provide complete cooling systems for Diesel locomotives from the smallest switchers to the largest road locomotive. Each unit in this Young-developed system—supercharger intercooler, radiator, heat exchanger and cab heater—is correctly rated to the job and coordinated to perform faithfully, efficiently. Take advantage of single source economy and efficiency with Young "integrated" heat transfer engineering. Coupon below brings further details.

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HEAT TRANSFER PRODUCTS FOR AUTOMOTIVE AND INDUSTRIAL APPLICATIONS.

HEATING, COOLING, AND AIR CONDITIONING PRODUCTS FOR HOME AND INDUSTRY.

T. M. REG. U. S. PAT. OFF.

YOUNG RADIATOR COMPANY

DEPT. 400-E, RACINE, WISCONSIN

Plants at Racine, Wisconsin and Mattoon, Illinois

DISCOVER FOR YOURSELF NEW HEAT TRANSFER ECONOMY

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Please send me information about:
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☐ Heat Exchangers ☐ Intercoolers

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Company_____
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City_____ Zone_____ State_____

All-Cuprous Removable Bundle Exchanger

A new line of standardized exchangers, featuring all-cuprous, removable tube bundle construction, is now in quantity production by Ross Heater & Manufacturing Company. Designated Type DCP, the line is available in a broad range of sizes which not only compare favorably in cost with many iron and steel shell units, but actually cost less in the smaller sizes. Originally designed for service in Navy combat vessels, the Type BCP has just been extensively redesigned. Not only has it been adapted to low-cost, quantity production, but now embodies larger transfer surface. A smaller, less expensive unit now serves the same conditions that formerly required larger, costlier sizes. A new, 8-page bulletin containing complete design details and illustrations may be obtained by writing Ross Heater & Manufacturing Company, Inc., 1407 West Ave., Buffalo 13, New York.

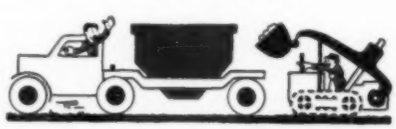
Cooper-Bessemer Contracts British Firm to Build Compressors Abroad

A contract recently concluded between The Cooper-Bessemer Corporation and Harland & Wolff, Ltd., world-noted shipbuilder and engine manufacturer, now licenses Harland & Wolff to build Cooper-Bessemer "V" angle-type compressors abroad. The compressors covered by the contract are the type JM motor-driven units, and the GMX, GMV and GMW "V" angle-type gas engine-driven units. International teamwork helps direct American-designed to dollar-short areas of the world. Gordon Lefebvre, president of The Cooper-Bessemer Corp., one of the leading American engine builders, adds the final touch to the contract. Shown left to right: H. A. Gehres, Cooper-Bessemer director of engineering; L. F. Williams, secretary; Gordon Lefebvre; B. B. Williams, Cooper-Bessemer Board Chairman; and Norman McaCllum, assistant manager London office of Harland & Wolff, Ltd.

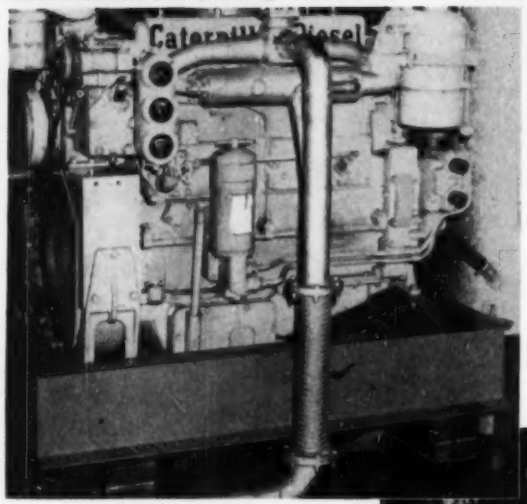
Trouble Spotter

Professor P. H. Schweitzer, of Penn State, one of the outstanding authorities on diesel combustion and diesel operation in general, has derived one of the most useful gadgets ever used in the diesel industry. It is called the "Trouble Spotter," and it is just that. The purpose of this guide is to enable the operators and service men of diesel equipment to locate and remedy troubles encountered in diesel engine operation.

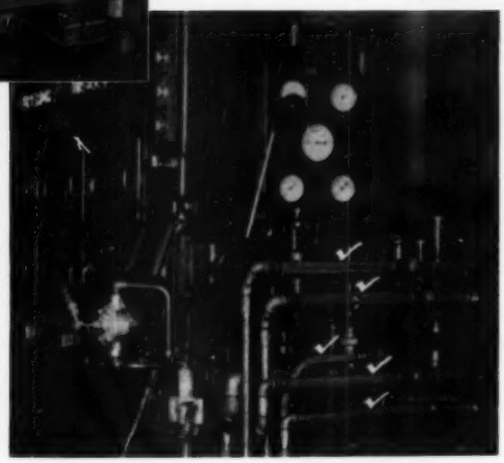
The Schweitzer Trouble Spotter is 4¼x8¼ inches and works with slide rule accuracy. It is accompanied by a complete guide, 26 pages and cover. Price complete, $3.00, from Edward M. Power Co., Inc., Graite Building, Pittsburgh, Pa.



Eliminate the "Shakes" in . . .



✓ Exhaust Lines
✓ Oil Lines
✓ Fuel Lines
✓ Water Lines
✓ Air Lines



with CMH REX-WELD Flexible Metal Hose

There's no need to worry about the shakes in fixed piping connected to internal combustion engines if you use CMH REX-WELD Flexible Metal Hose assemblies. They effectively absorb vibration in exhaust, fuel, air, oil and water lines. By isolating vibration, maintenance is reduced, shutdowns minimized. Installation misalignment problems are solved, too.

CMH Rex-Weld is all-metal, corrugated flexible metal hose that is pressure and vacuum tight and highly resistant to fatigue. Rex-Weld Flexible Exhaust Connectors are available in all required sizes with choice of fitting attachments. Rex-Weld Flexible Metal Hose for fuel, air, oil and water is available in bronze or steel with couplings to meet your needs.

Write for data sheets today and ask about other CMH Flexible Metal Hose Types.

Flexon identifies CMH products that have served industry for over 48 years

CHICAGO METAL HOSE Corporation
1325 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
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CMH **ONE DEPENDABLE SOURCE**
for every flexible metal hose requirement

New Hydraulic Pressure Testing Intensifier

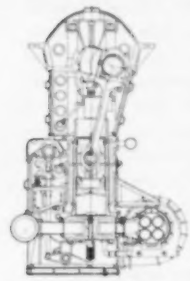
A simple set-up for static pressure testing of boilers, piping systems, compressor cylinders and similar pressure vessels is now being made possible by a new, air operated hydraulic pressure generating device. Developing up to 23,000 pounds per square inch, the new device, known as the Cooper-Bessemer Intensifier, is suitable also for many types of laboratory destruction tests where extremely high pressures are involved. The Intensifier is compact in design, as it weighs only 80 pounds and is mounted on a two-wheel rubber tired under-carriage for easy portability to any testing job. The operation of the unit requires only the connecting of the Intensifier to any ordinary compressed air line—a desired feature for pressure testing in potentially explosive atmospheres where electric motor driven equipment is usually considered hazardous.

In operation, the Intensifier draws oil from its built-in supply reservoir. Variable static hydraulic pressures are preset by a turn of the Intensifier's regulator valve that is equipped with a dial type air pressure gauge. Discharge pressures are visibly indicated on a large direct reading dial gauge. Any static pressure up to 23,000 psi. can be quickly built u pby using air line pressures up to 90 psi. The Cooper-Bessemer Corporation, Mount Vernon, Ohio, has published a free bulletin, now available, giving details.

Dieselization on Rock Island

Further steps toward eventual complete dieselization of the Rock Island Lines was announced at the railroad's Board of Directors meeting in Chicago. The Board authorized the purchase of twenty new diesel locomotives to cost approximately $2,500,000.00. In making the announcement, J. D. Farrington, president of the Rock Island, said the new locomotives would be assigned as follows: twelve 1,500-hp. units for road and switching operations; one 2,250-hp. engine for passenger service; and seven 800-hp. units to be used in switching. The additional twenty diesel locomotives, when delivered, will make the railroad one of the largest users of diesel power in the country.

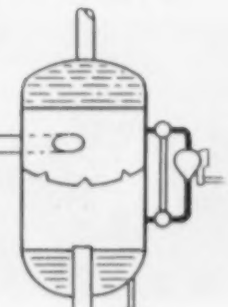
New Nordberg Marine Diesel



The Nordberg marine diesel engine is described in Bulletin 175, recently published by Nordberg Manufacturing Co., Milwaukee 7, Wis. This marine diesel engine is of the four-cycle, single acting, mechanical injection, trunk piston, direct reversing design. This engine has a 16½-inch bore and 24½-inch stroke and is built with six, seven and eight cylinders, supercharged or non-supercharged, with ratings up to 1,900 hp. at normal speed of 300 rpm. Like other four-cycle Nordberg diesels, this model is built by the Busch-Sulzer Division of Nordberg Manufacturing Co. at St. Louis, Missouri. Bulletin 175 describes the reverse and control gear, cooling lubricating and fuel injection systems of this engine. Advantages of supercharging are listed and an engine cross section is shown. Dimensions and horsepower ratings of the engine are also given in this bulletin, which is available free upon request to Nordberg Manufacturing Co., Milwaukee, Wis.

Diesel Engine Catalog now available in its Fourteenth Edition. See the unique Diesel Horsepower Range Chart — invaluable aid to design engineers and buyers. ORDER COUPON ON PAGE 89.

any* VAPOR PHASE *equipped engine
can equal or better this record...



93,511 HOURS IN 11 YEARS
(ON UNTREATED ACID FUEL)
Repair Costs to date $411.94

In a truck, this would equal 2,805,333 miles at 30 m.p.h.

That's the record of a VAPOR PHASE equipped 40 HP Enterprise 1000 RPM Engine operating on raw sewage gas in the Visalia, California Sewage Plant. It went into service July 1, 1939 and to date, April 1, 1950, has chalked up a record of 93,511 hours and still going strong! Up to last overhaul, engine had operated continuously for 564 days without major work being done.

That's a rugged test, and quite a record in view of the fact that back in '39 this engine replaced an identical conventional system engine that had broken down completely after only 5 months' service. Yes, VAPOR PHASE makes the difference!

Now, another new 80 HP engine is being installed in this same plant and, later this year, two more 80's are scheduled—all VAPOR PHASE equipped, of course!

Regardless of engine size or type—Diesel, Gasoline or Gas—regardless of fuel used, load requirements, altitude or ambient temperatures—anything from sub-frigid to burning desert—VAPOR PHASE converts your conventional system engine into a long life, super-efficient power unit, unaffected by conditions. And saves you almost unbelievable operation costs!

VAPOR
AUTOMATIC UNIFORM TEMPERATURE CONTROL
PHASE

• A Vapor Phase equipped engine also serves the multi-purpose job of generating power, heating water, fluids, space or other process—all at the same time, at one low operating cost.

Write for complete case history records, catalog and information applying to your specific needs.

Your first year's Savings more than Pay for Vapor Phase

ENGINEERING CONTROLS, INC., 2835 E. Eleventh St., Los Angeles 23
Offices in Most Principal Cities

Diesel Locomotive Production in Canada

Montreal Locomotive Works, Ltd., introduced in 1948 a new Canadian industry—the manufacture of diesel-electric locomotives. Since that time, it has turned out 80 diesel-electric units, making it the foremost producer of diesel locomotives in Canada. The company is working in close cooperation with Canadian General Electric and Dominion Engineering in the achievement of practically an all Canadian product. Montreal Locomotive has a backlog of $14,000,000 in orders, compared with $27,000,000 a year ago. The orders are largely for diesel-electric locomotives, whereas last year's backlog of orders was largely for steam equipment. Mr. Fraser, chairman of the board of directors, pointed out: "The ever-increasing trend from steam to diesel locomotives attests to the wisdom and timeliness of our inauguration of this new industry. The great economies of this type motive power, both in operation and maintenance, are clearly apparent to roads which have been dieselized. It is our conviction that the coming years will see the replacement of most steam locomotives by diesel-electrics on Canadian railways and that consequently our future production will be predominantly diesel-electric."

Diesel Engine Catalog now available in its Fourteenth Edition. See the unique Diesel Horsepower Range Chart — invaluable aid to design engineers and buyers. ORDER COUPON ON PAGE 89.

IN THE OYSTER INDUSTRY...

HARBORMASTER

equipped, the "Quinnipiac's" extreme maneuverability enables this newly designed dredge to clean and plant the oyster beds more thoroughly with about 20% of the effort.

IN RIVER TOWING...

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powering the 597' "Cartasca" tow have conclusively proved after 3 years continuous heavy duty service the dependability and economic operation of these remote-controlled Units.

AUXILIARY TOW POWER...

HARBORMASTERS

increased the speed of the "Bull Calf" tow 1.57 mph with a full load between New Orleans and Wood River.

IN HEAVY DUTY marine fields, the Harbormaster system of outboard propulsion and steering has proved its economy and dependability. For working facts and actual case histories of the money and time saving that Harbormaster operators are daily earning, write today.

MURRAY & TREGURTHA, INC.

High Fidelity Marine Engines since 1885

28 HANCOCK STREET, QUINCY 71, MASS., U. S. A.

Appointments at Mack

A. F. Fenner **P. J. Degnon**

A. F. Fenner, vice president of Mack International Motor Truck Corporation, has been named general sales manager, with headquarters in Chicago. The announcement explained that Mr. Fenner will direct all the company's truck, bus, and fire apparatus sales and service activities in its Central, Southwestern and Pacific Coast Divisions as well as the Republic of Mexico. P. J. Degnon (right), vice president of Mack-International also, has been named manager of the company's newly created eastern sales division, composed of the former New England, Northeastern, Metropolitan New York and Northern New Jersey.

E. G. Ewell

E. G. Ewell, vice president of Mack-International Motor Truck Corporation, has been named general sales manager of the company's eastern, southern and Atlantic sales divisions, it was announced by H. W. Dodge, executive vice president. In his new position, Mr. Ewell will be in charge of all Mack truck, bus and fire apparatus sales activities in the eastern half of the United States.

Appointment at Perfect Circle

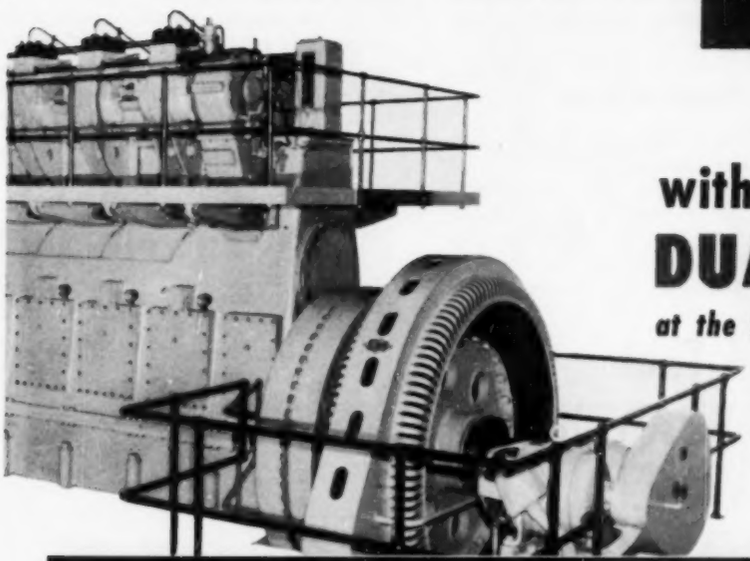
Chas. L. Strahota

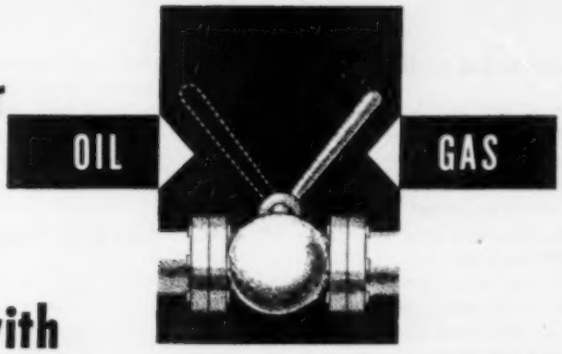
Appointment of Charles L. "Chuck" Strahota as Perfect Circle's manufacturers' service sales manager in the Chicago-Cincinnati areas was made recently. Chuck replaces M. R. Swearingen, who resigned to enter business for himself. For the past two and one-half years, Chuck has been with Nash service and parts in Kansas City. He got his start in automotive sales, service, and parts seven years ago with Nash in Kenosha, Wis. He is a graduate of the University of Wisconsin. While in college he was a member of Alpha Delta igma, professional journalism fraternity, and the Wisconsin Advertising Club.

Price Reduction Announcement

Hunt-Spiller Mfg. Corp., Boston, recently announced a price reduction of more than 25 per cent on its 12¾-inch bore, unplated, diesel locomotive cylinder liner, according to F. W. Lampton, vice president and general sales manager. The 275-pound liner, fully machined, is cast of a special alloyed air furnace iron.

2 second change-over





with DUAL FUEL FULTONS

at the flick of a lever, without missing a beat!

On a 2 seconds' notice you can switch from oil to gas or from gas to oil—whichever economy, emergency, or other situations dictate.

FULTON IRON WORKS COMPANY
SAINT LOUIS 14, MISSOURI
New York Office: 82 Wall Street, New York 5

You'll get more KW hours from any fuel in
FULTON
DIESEL AND DUAL-FUEL ENGINES

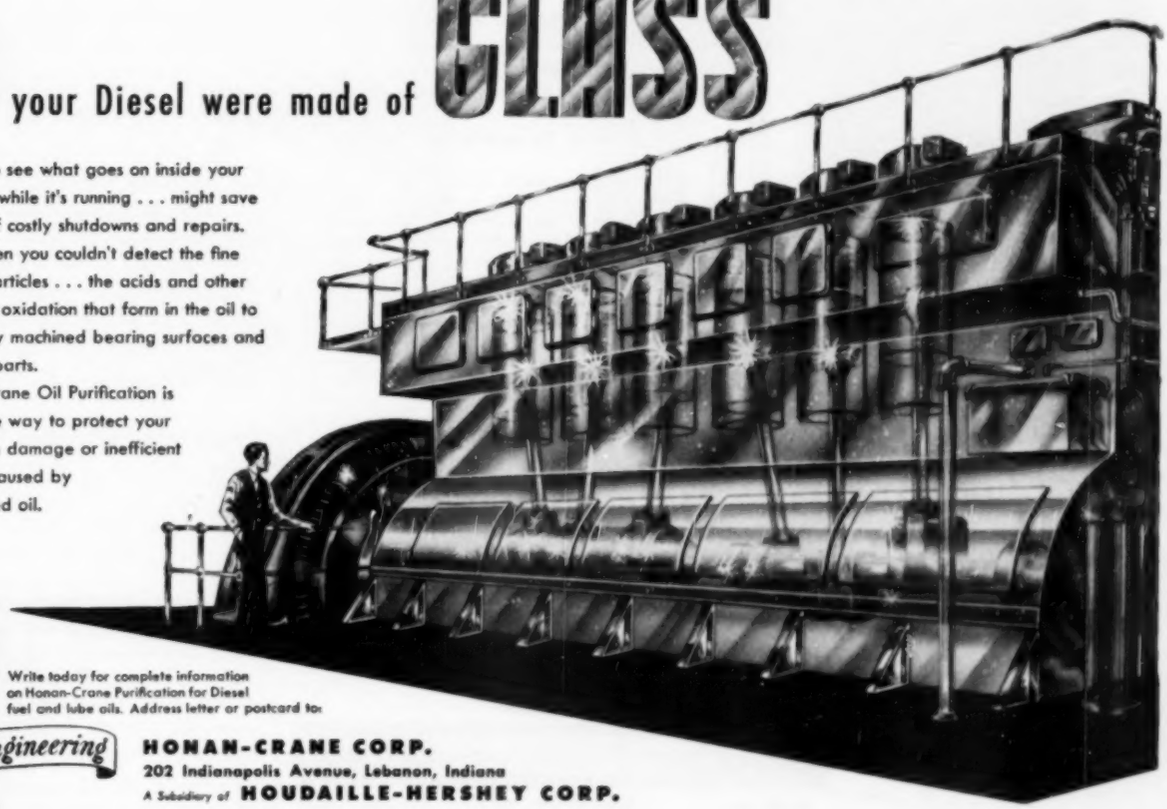
FULTON DIESELS—your best buy in the long run

---

if your Diesel were made of GLASS

A chance to see what goes on inside your engine . . . while it's running . . . might save you a lot of costly shutdowns and repairs. But even then you couldn't detect the fine abrasive particles . . . the acids and other products of oxidation that form in the oil to attack finely machined bearing surfaces and other vital parts.

Honan-Crane Oil Purification is the one *sure* way to protect your engine from damage or inefficient operation caused by contaminated oil.



Write today for complete information on Honan-Crane Purification for Diesel fuel and lube oils. Address letter or postcard to:

Clean Oil Engineering

HONAN-CRANE CORP.
202 Indianapolis Avenue, Lebanon, Indiana
A Subsidiary of **HOUDAILLE-HERSHEY CORP.**

Erie Road to Buy 62 Diesel Locomotives

Directors of Erie Railroad have authorized purchase of sixty-two additional diesel locomotives to cost more than $10,500,000, the company announced recently. The order is the largest single diesel order ever placed by the company, which now has 178 diesels in service and 75 on order, P. W. Johnston, president, said. The acquisitions will reduce steam locomotives on the road to 206, with the steam power eliminated completely on eleven divisions from Meadville, Pa., to Suffern, N. Y. The new orders, aggregating 97,000 horsepower, have been placed as follows: American Locomotive Co., two road freight locomotives of 6,000 horsepower each, and fourteen 1,500-horsepower road switchers; Electro-Motive Division of General Motors Corp., twenty-six 1,500-horsepower road switchers, and five 1,000-horsepower yard switchers; Baldwin Locomotive Works, nine 1,500-horsepower road switchers; Lima-Hamilton Corp., six 1,000-horsepower yard switchers.

New Proto Torque Wrenches

Addition of twelve high-speed PROTO torque wrenches that are controlled by three senses—feeling, sound and sight—has been announced by M. B. Pendleton, President of the Plomb Tool Company, Los Angeles, Calif. A trip lever is set at the desired torque reading, and when the wrench is pulled to this exact reading the lever trips a signal trigger. An impulse is imparted to the hand and a loud click is sounded. The resulting sensations of feeling and sound cause the operator to release the wrench at the desired torque setting. The operator may also watch a pointer advance along an easy-to-read dial and see when the proper torque is reached. Six wrenches have capacities of 25, 50, 100, 150, 200 and 300 foot-pounds. The other six have capacity limits of 300, 600, 1200, 1800, 2400 and 3600 inch-pounds.

These Parts PROVE That

D-X DIESEL MOTOR OIL SAVES WEAR!

(LOOK AT THESE UNRETOUCHED PICTURES)

These parts were taken from a GMC 371 Diesel Engine in a Unit dragline operated for 6,500 hours under the most severe conditions. The owner of this dragline, the Van Dusseldorp Construction Company of Colfax, Iowa, used only D-X Diesel Motor Oil and D-X High Speed Diesel Fuel during these 6,500 hours.

See How Little Wear An Inspection Disclosed

No perceptible wear on the piston pin! Only .0025" wear on the thrust side of the cylinder liner. Intake ports of liner still clear. Piston rings still serviceable. And only .005" wear on the crankshaft. Look at the pictures again. Practically no wear after 6,500 hours of operation with D-X lubrication.

USE D-X DIESEL MOTOR OIL IN YOUR DIESELS

You can get results like this with D-X Diesel Motor Oil. D-X distributors and bulk stations are located throughout the Middle West. Call or write the D-X branch office nearest you for information, prices and terms.

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TULSA, OKLAHOMA

Waterloo, Ia. Terre Haute, Ind. Omaha, Nebr.
Chicago, Ill. Minneapolis, Minn.

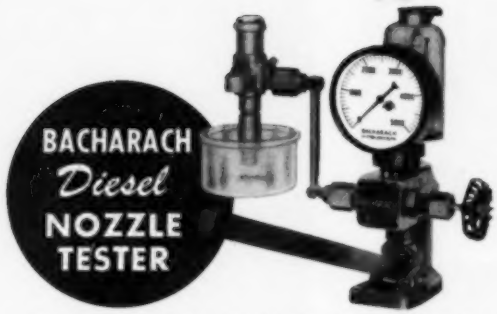
President of Fairbanks, Morse & Co.

The third generation Morse became president of Fairbanks, Morse & Co., on March 22, 1950. Robert H. Morse, Jr., who started with the company in 1916 in the foundry of the Beloit, Wis., plant, was elected to the presidency of the directors, following the annual meeting of stockholders. Mr. Morse has been vice president in charge of operations. Previously he was vice president in charge of sales, assistant general sales manager, and has held other positions. His father, Colonel Robert H. Morse, whom he succeeded, becomes chairman of the board. Colonel Morse has been president since 1931 and has spent 55 years with the comppany. He also started in the Beloit plant. His grandfather, Charles Hosmer Morse, was the founder of the company and was chairman of the board upon his death in 1921. It was in 1847 when he bound himself out for $50 a year to learn the scale business with the firm which later became the present company. Mr. Morse is also president of the Diesel Engine Manufacturers Association.

Improving Diesel Engine Service

In a move designed to improve service to its diesel engine customers, American Locomotive Company diesel engine sales and repair parts departments have been transferred from Auburn, New York, to Schenectady, New York, effective immediately, according to a company announcement. Customers have been notified that all communications relating to Alco or McIntosh and Seymour Marine and Stationary diesel engines and parts should be addressed to Sales Department or Renewal Parts Departments, American Locomotive Company, Schenectady, New York.

Diesel Engine Catalog now available in its Fourteenth Edition. See the unique Diesel Horsepower Range Chart — invaluable aid to design engineers and buyers. ORDER COUPON ON PAGE 89.



Promotes Rapid and Effective Servicing of *All* Makes of Diesel Nozzles and Injectors

All Diesel injection nozzles, due to the nature of their operation and the severe conditions to which they are subjected in service, require maintenance at regular intervals. That's why the need of nozzle cleaning and testing is emphasized in every Diesel builder's instructions.

The Bacharach Nozzle Tester provides a dependable means for checking nozzles accurately. Its low price — $79.00 — makes it a worthwhile investment for every Diesel operator and service shop. A complete line of connector fittings is available for American Bosch, Excello, Demco and Bendix nozzles; as well as GM 71 and Cummins unit injectors.

Ask your engine parts jobber to show you the Bacharach Nozzle Tester and our other Diesel testing instruments, or write for Bulletin 617.

BACHARACH Industrial Instrument Company
7000 Bennett Street · Pittsburgh 8, Pa.

SCIENCE IN THE FOUNDRY explains and illustrates the foundry techniques which have been developed to combine science with craftsmanship. It demonstrates how controls and high standards at Campbell, Wyant and Cannon Foundry Company make possible the casting uniformity so necessary to the Diesel industry of today. It tells you of our metallurgical advancements that lead to new freedom for the design engineer. It contains charts of physical properties and typical applications which simplify the selection of metals for your castings. Write for your free copy today.

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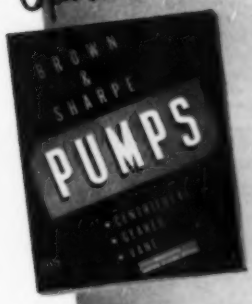

Send for a copy of this Catalog and see how many quality-built Brown & Sharpe Pumps are available for diesel use. A wide range of types and sizes in standard rotary geared pumps with various styles of special mountings greatly simplifies the right selection for the job. Have a catalog handy for quick reference. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

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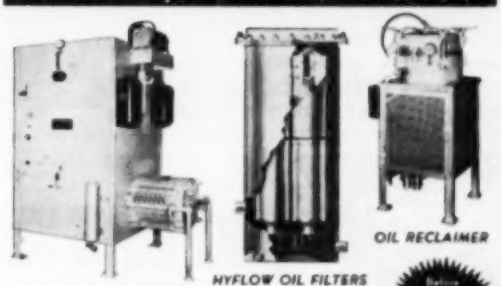

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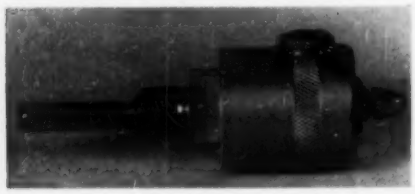
Water Temperature Alarm



The 90-hp. General Motors diesel in the Cascade Laundry, described on pages 58-59 of our April issue, is equipped with an Alarmstat, a water temperature alarm, manufactured by Kysor Heater Co., of Cadillac, Michigan. This device warns of overheated motors. It is installed on the motor in such position that a thermostatic liquid tube in the unit is in constant contact with the engine cooling water at the point of highest temperature. When the water temperature has reached the predetermined point (usually between 210° and 225°) electrical contact is automatically effected, showing a light or sounding a buzzer warning. These Kysor alarmstats are easily installed on all types of internal combustion, gasoline or diesel engines. They are also installed and have been tested and proved on thousands of motor coaches, trucks and stationary engines.

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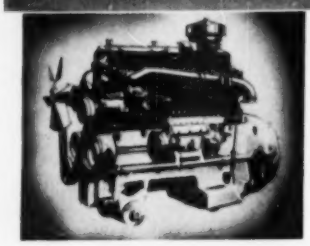
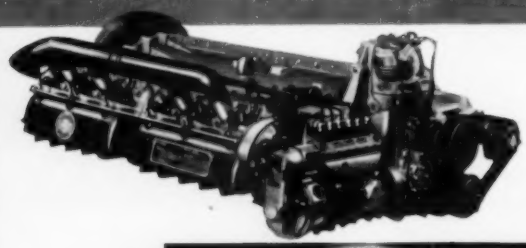
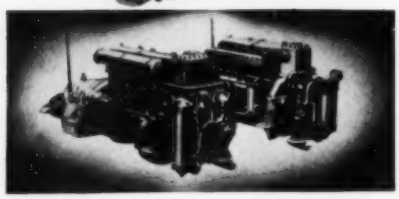
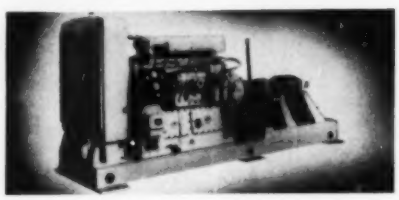
DIESEL POWER





From the vast A.E.C. organization comes the motive power for transport on land and sea in most parts of the globe, as well as stationary power units for countless factories. Apart from their other activities, A.E.C. have produced in 20 years Diesels aggregating a total of FIVE-AND-A-QUARTER MILLION HORSE POWER! Since organized road transport was created in London, A.E.C. have been the main suppliers of the chassis which carry 7½ million Londoners daily.





A full range of A.E.C. Diesels will be showing at
THE CANADIAN INTERNATIONAL TRADE FAIR, TORONTO, on STANDS 976/7 & 996/7

The illustrations above show: (Top left): The 9.6 litre 6-cylinder Diesel. (Top right): The [illegible] horizontal Diesel. (Center): A handed pair of 6-cylinder marine Diesels. (Bottom): The 9.6 litre stationary Diesel.

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For ROAD TRANSPORT
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CANADA: THE ASSOCIATED EQUIPMENT CO. OF CANADA, LTD.
Keefer Buildings, 1440 St. Catherine Street West, Montreal, Quebec

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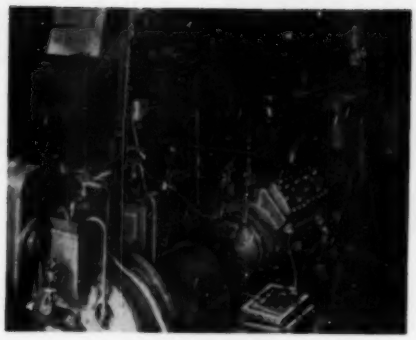
New Diaphragm Pump

It has been said the diaphragm pump has always been recognized as the most satisfactory type pump to handle water containing heavy solids and stringy material. However, the bulk and weight of the diaphragm pump have discouraged its use on small dewatering jobs even where these conditions are encountered. The C. H. & E. Manufacturing Company, Milwaukee Wis., has a new compact diaphragm pump that weighs 185 pounds and pumps 3,000 gallons per hour. It is of all steel construction, straight line waterflow, roller bearing shafts, swing type valves, and is completely enclosed. Both suction and discharge connections are arranged for optional use of 2-inch or 2½-inch hose. Connections are tapped 2-inch inside and threaded 2½-inch outside. A cleanout equipped with removable hand screws provides access to discharge valve and water passage. Additional information may be had by writing C. H. & E. Manufacturing Co., Milwaukee 12, Wisconsin.

Diesel Engine Catalog now available in its Fourteenth Edition. See the unique Diesel Horsepower Range Chart — invaluable aid to design engineers and buyers. ORDER COUPON ON PAGE 89.

Power Plant Operators' Conference

A course in diesel engine operation and maintenance was held at the Oklahoma Agricultural and Mechanical College on April 17, 18 and 19. This course was offered by the School of Mechanical Engineering in cooperation with the Division of Engineering and Industrial Extension. The program was designed primarily for diesel power plant operators. The principles of diesel engine operation and practical operating problems were covered during the three day meeting.



The topics which proved most interesting were: (1) How power is produced. (2) Fuel injection systems. (3) Lubricating systems. (4) Dual-fuel and gas diesels. (5) Cooling systems. (6) Trouble-shooting. The Conference leaders were Professors W. H. Easton and B. S. Davenport, of the Mechanical Engineering staff. There was a very interesting discussion of trouble-shooting problems by a panel of power plant operators headed by Pat Schlessinger, Superintendent of Power at Ponca City, Oklahoma. Many representatives of the diesel engine manufacturing companies attended in addition to a very encouraging number of diesel plant operators. Figures 1 and 2 show the fine equipment that is now installed at Stillwater, Oklahoma, which has built itself up to be one of the best diesel schools in the whole country.

New Heavy Duty Vibration Control

A new vibration isolator is now available for mounting pumps, compressors, fans, engine-generator sets, and other equipment where efficient, economical and rugged isolation is required. This isolator was designed primarily for original equipment manufacturers and is intended for either marine, mobile or stationary installations. The housings are malleable castings, sealed by a cylindrical cork ring, which snubs horizontal thrust and prevents all metal-to-metal contact. Vertical thrust control and sound insulation are also provided in this unit. This Korfund type F. Vibro Isolator is furnished with several standard spring capacities for loads from 10 lbs. to 500 lbs. per isolator. It is manufactured by The Korfund Company, 48-20-B, 32nd Place, Long Island City 1, New York.

Appointment at National Supply

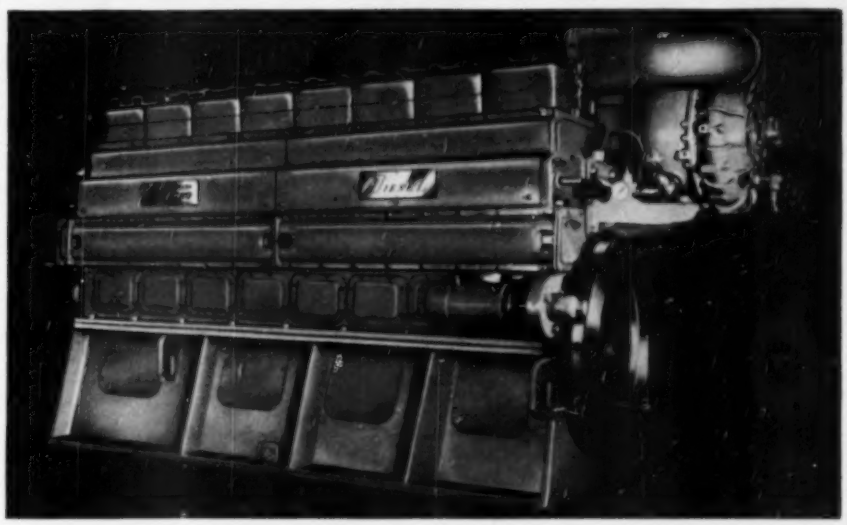
Martin H. Miller

The National Supply Company has announced the appointment of Mr. Martin H. Miller as Plant Controller of its Superior Division, Springfield, Ohio. Mr. Miller will coordinate all financial functions of the Springfield plant. After joining The National Supply Company in 1934 as a mail boy, he held successively the positions of cost clerk, chief cost clerk, and budget supervisor. In 1949 he was made Superior Engine Division office manager. Mr. Miller attended the Ohio Western Business College and has received instruction on accounting procedure under the direction of Antioch College. He is presently a member of the National Association of Cost Accountants.

More POWER... *Less* SPACE

WITH

STERLING VIKING DIESELS



This 8-cylinder turbo-supercharged Viking Diesel is conservatively rated at 750 hp. Sterling Diesels are available in five different models beginning at 100 hp.

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AUTOMATIC POWER PLANTS
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Sterling Viking Diesel engines offer definite advantages in:

Compactness . . . more power in less space. A high ratio of horsepower to weight.

Sturdy construction . . . one piece block and base. All working parts are easily accessible.

Dependability . . . Service records show a high operating efficiency, low maintenance cost. All Sterling Diesels are conservatively rated, built to deliver smooth performance over their full power range.

Without cost or obligation, talk over your power requirements with an **experienced** Sterling engineer. We invite your call and the opportunity to bring you up to date on Sterling's accomplishments.

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REVISED ANNUALLY.

This comprehensive book is brought up-to-date every year. Carefully revised and checked by the manufacturers themselves, its complete and profusely illustrated data include numerous changes, new types and models and re-designs with up-to-the-minute information on diesel and dual-fuel engines manufactured in this country.

Design and Consulting Engineers keep Diesel Engine Catalog at hand for easy reference throughout the year.

Product Engineers find its accurate, easy-to-find data of great value.

Engine operators use its wealth of factual information as an invaluable aid to good maintenance and service.

Technical Instructors and Students consult it as an unsurpassed reference book.

GINE CATALOG

The following are manufacturers whose engines are fully described with tabulated specifications:

American Locomotive Company
Atlas Imperial Diesel Engine Co.
Baldwin Locomotive Works
Buckeye Machine Co.
The Buda Engine Co.
Burmeister & Wain
Caterpillar Tractor Co.
Chicago Pneumatic Tool Co.
Clark Brothers Co., Inc.
Consolidated Diesel-Electric Corp.
Continental Motors Corp.
Cooper Bessemer Corp.
Crofton Diesel Engine Co., Inc.
Cummins Engine Co., Inc.
Enterprise Engine & Foundry Co.
Fairbanks, Morse & Co.
Flagship Engine Co.
Fulton Iron Works Co., Inc.
Generals Motors Corp.
Cleveland Diesel Eng. Div.
Detroit Diesel Engine Div.
Electro-Motive Div.
Gray Marine Motor Co.
Hallett Manufacturing Co.
Harnischfeger Corp.,
P & H Diesel
Hercules Motors Corp.
Hill Diesel Engine Co.
Div. of Drake America Corp.
Ingersoll-Rand Co.
International Harvester Co.
Kermath Manufacturing Co.
The Lathrop Engine Co.
Lima Hamilton Corp.
Lister-Blackstone, Inc.
Mack Manufacturing Corp.
Mechanical Equipment Co.
Murphy Diesel Co.
National Supply Co.
Nordberg Manufacturing Co.
Palmer Brothers Engines, Inc.
The Rathbun-Jones Engineering Co.
John Reiner & Co., Inc.
R. H. Sheppard Co.
Stewart & Stevenson Services, Inc.
Sun Shipbuilding & Drydock Co.
The Union Diesel Engine Co.
United States Motors Corp.
Venn Severin Machine Co.
Washington Iron Works
Waukesha Motor Co.
White-Roth Machine Co.
Witte Engine Works
Wolverine Motor Works, Inc.
Worthington Pump & Machinery Corporation

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INDISPENSABLE for BUYERS!

INVALUABLE to INSTRUCTORS & STUDENTS!

IN NO OTHER BOOK can be found such complete and detailed information on diesel engines and accessories. Rewritten in its entirety while being brought up-to-date, great attention has been given to make Diesel Engine Catalog an easy-to-read book. Its unique charts showing Diesel Horsepower Ranges by manufacturer and its comprehensive classification and indexing, all contribute to making any item easy-to-find.

FIVE BOOKS IN ONE HAVING FIVE INTEGRAL SECTIONS, this catalog is indispensable whether for technical reference or selective buying:

(a) An engine section fully illustrated with complete descriptions and specifications.

(b) An accessory section describing engine and plant accessories.

(c) A transmission section—a new feature in this volume.

(d) A classified buyers' guide—"Market Place," covering Diesels, accessories, transmissions and other allied products.

(e) A large advertising section. Manufacturers' advertisements carry a wealth of information for design and purchasing engineers.

DIESEL HORSEPOWER RANGE CHART: This catalog includes a new and startling chart showing horsepower ranges of diesel engines classified by manufacturer. By giving at a glance the range of horsepower ratings of the engines offered by each firm, it is a new and valuable aid to all connected with the Diesel Industry.

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Enter my order today for a copy of the 1949 Diesel Engine Catalog, Volume Fourteen. Edited by Rex W. Wadman, for which I enclose $10.00, also payable at £3. 5s. 0d. to E. H. Doddrell, 342 St. Paul's Corner, Ludgate Hill, Dondon E.C.4.

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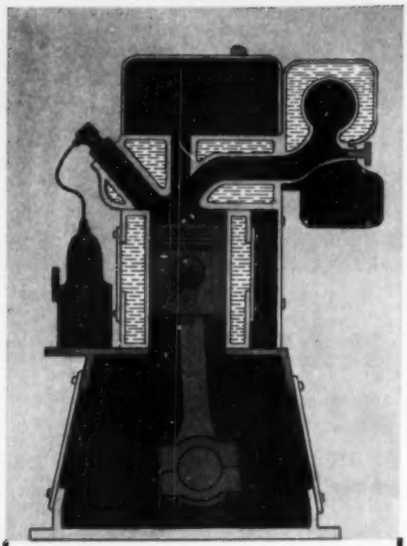

Easy Way to Descale Jacket Water Coolers

DID you know you can remove lime-scale and rust accumulations from the water-sides of your Diesel jacket water coolers and other heat exchange units without dismantling equipment? It's a fact when you use Oakite Compound No. 32!

Simply circulate recommended solution of this scientifically-designed Oakite inhibited-acid compound through cooling system. Without damaging the metal, Oakite Compound No. 32 quickly, thoroughly removes scale and rust . . . restores heat exchange efficiency, with very little downtime.

Available to responsible persons is a 16-page illustrated Manual containing many practical ideas for expediting Diesel maintenance . . . keeping Diesel operation costs low. Up for discussion are such subjects as:

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- **Cleaning before Overhaul**
- **Cleaning inter-coolers**
- **Steam-Detergent Cleaning of hard-to-reach areas**

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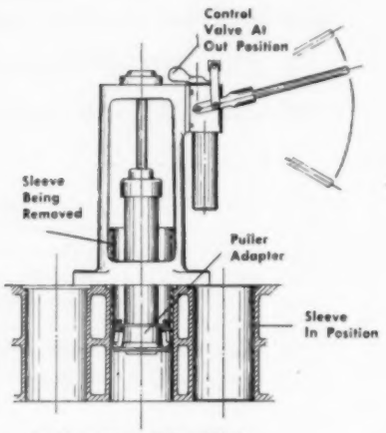
Technical Service Representatives in Principal Cities of U. S. & Canada

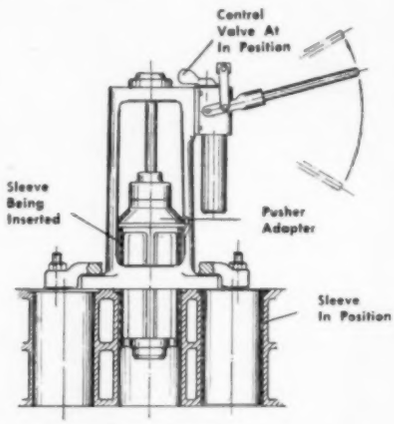
New Hydraulic Sleeve Machine

The Marvel Tool & Machine Company of St. Clair, Michigan, now has on the market a new hydraulic sleeve-removing machine that is most adaptable in the maintenance and overhaul operation of trucks, tractors, busses, diesels and stationary engines. Removing the sleeve with the Marveco is hydraulically operated and does not require an experienced mechanic to handle. The machine itself is a compact unit weighing only 35 pounds, and removes the worn sleeves and pushes in the new sleeves. Fifty pounds of pressure on the handle exerts a pull of 20,000 pounds, and during the operation, the sleeve is always in alignment with the cylinder wall—thus eliminating broken, warped, cracked or bent sleeves.

Actual operation of the Marveco is simple. After motor is disassembled the machine is placed over bore of cylinder. The control valve is turned to IN position and lever is pumping machine cylinder down until fingers catch the bottom of the sleeve which is ready to be pulled. The control valve is then turned to OUT position and the sleeve is removed. A diagram below shows the cutaway view. The Model A Marveco takes up to 5-inch bore in 11¼-inch length. Additional information can be had by writing Marvel Tool & Machine Company.

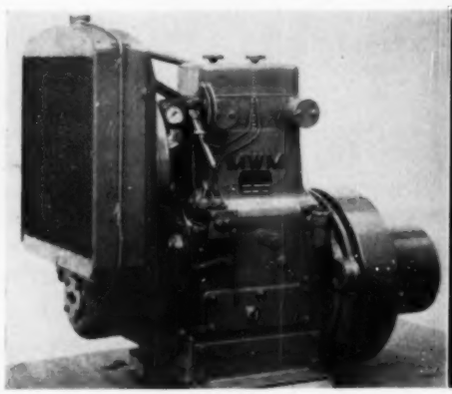


Cut Away View of Motor Block

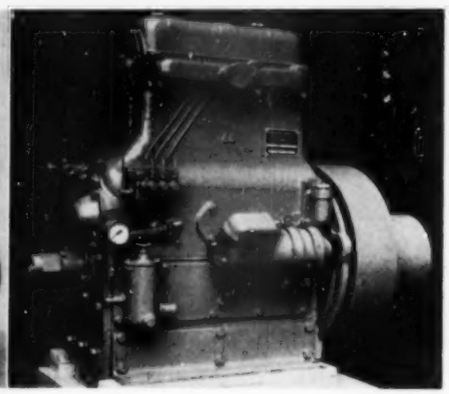


Cut Away View of Motor Block

The M.W.M. Mannheim Diesel



Two-cylinder, Model KD 415Z, 22-hp., MWM diesel fitted with radiator.



The 3-cylinder, 33-hp., MWM diesel, Model KD 415D.

NEW to the American market, but the product of one of the earliest diesel engine builders in Europe, is the M.W.M. Mannheim diesel. The Motoren-Werke, Mannheim A.-G., formerly the Benz Division of Stat. Motorenbau, Mannheim recently offered for sale in America, through its exclusive representative, Ernest L. Frankl, Associates, in New York, the Model KD engines in one, two and three cylinder versions, rated 12 hp., 22 hp., and 33 hp., respectively.

The M.W.M. Model KD diesels are seen as rugged engines which have been developed from field experience going back more than forty years, having first been applied to a variety of farm and industrial types of tractors on the Continent. Later, these engines were adapted for all types of heavy-duty industrial service. This is a 4-cycle, solid injection diesel with cylinder block cast in one piece, having clean outward appearance and large openings which provide good accessibility to gears and other internal parts. The base flange is cast on the crank case and is arranged for attachment of fittings for various types of drives. The crankshaft

is forged, with heat-treated main bearing journals turning in roller bearings. The timing shaft is also fitted with roller bearings. The cylinder head is cast in one piece and is fitted with a protecting cap which encloses the valve mechanism. Replaceable liners are long-wearing centrifugal castings. Pistons are special aluminum alloy. Fuel injection pumps are Deckel with built-in filter, and the engines are fitted with oil bath type intake air filters. Hand or electric starting is optional. Pressure-lubrication is provided to all working parts by a gear-driven oil pump and the lubrication system is fitted with a self-cleaning filter.

The KD Models have the same bore and stroke, 3.94 in. by 5.91 in., and fuel consumption is .43 lbs. per hp. hour. Weights of the bare engines are: 730 lbs. for the single cylinder, 905 lbs. for the 2-cylinder, and 1,256 lbs. for the 3-cylinder units. Motoren-Werke, Mannheim A.-G., is now prepared to make prompt deliveries, up to 500 per month, of the Model KD diesels and repair parts throughout the United States, and is planning soon to carry stocks of engines and parts in this country. The M.W.M. Mannheim line of engines also includes models ranging up to 1,000 hp.

Boston to New York by Diesel

Holland Transportation Company, Boston, Mass., was one of the first carriers to use diesel-powered tractors on the Boston to New York run. The Mack tractor and trailer combination is one of two hauling units powered with 200-hp. Cummins diesel now working in this fleet. Holland Transportation Company reports excellent results from the use of these Cummins-powered Mack tractors. The 500-mile run is made in 24 hours, including loading time and the time required to make local deliveries in New York City. The diesels average better than seven miles to the gallon of fuel, and in more than one year of heavy-duty operation neither engine has required an overhaul.

Mack Opens Free Diesel Training Courses

Free training courses on diesel-powered trucks and buses are being offered by the Mack Truck Company, it is announced by H. W. Dodge, executive vice president. Eligible for enrollment in these free diesel courses are truck owners, maintenance superintendents, shop foremen, garage or service station mechanics, and persons employed in any capacity allied to the maintenance or operation of trucks and buses. Highly qualified diesel engineers and instructors staff these diesel courses. Sessions run two hours one evening a week for ten weeks, with as many repeat terms as the number of applicants in any city warrants. Certificates are awarded to those satisfactorily completing the course. Already initiated in Boston, Albany and New York City, these courses have elicited tremendous response from transportation and trucking circles, reports Mr. Dodge.

New Product Bulletin

A new bulletin, describing a product that is adaptable to any industry, has been announced by the Diamond Power Specialty Corporation of Lancaster, Ohio. This product is called the "Utiliscope," wired television, that enables one to see an object, operation or condition of any piece of machinery that is working in any section of a plant or factory, comfortably behind a desk in an office. It is capable of studying destructive tests of machinery, the action of explosives, etc., keeping the observer at a safe distance. With the use of the "Utiliscope," instrument needles 1,000 feet away are clearly visible for reading. This type of observation can be used for steam gauges, ammeters, voltmeters, and other instruments located at a distance. This profusely illustrated bulletin is obtainable free upon request and may be had by writing the Diamond Power Specialty Corporation, Lancaster, Ohio.

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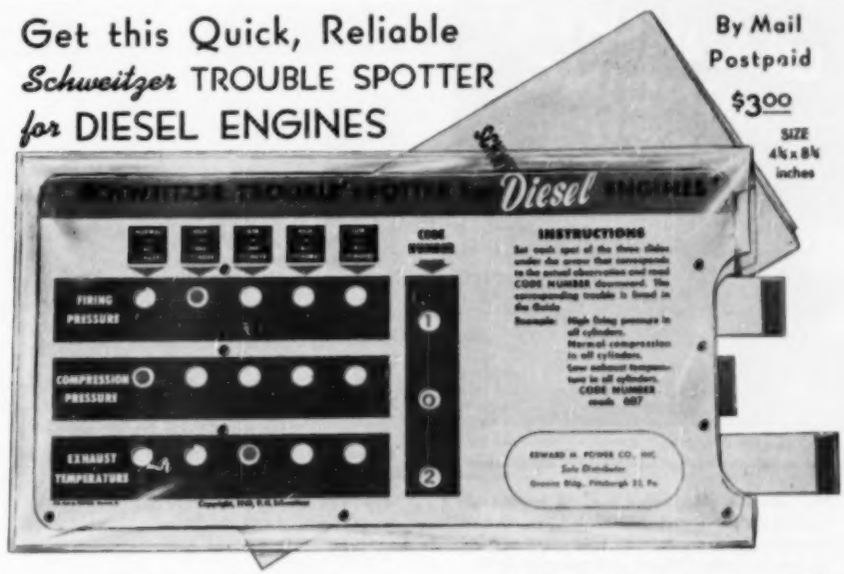

SLIDE RULE ACCURACY

This guide prepared by Paul H. Schweitzer, Dr. Eng. Penna. State College, in collaboration with Diesel Engine experts, enables operators and service men to locate and remedy troubles encountered in Diesel engine operation. Makes trouble spotting an easy semi-automatic process, and points unerringly to the proper remedy, thus saving a great amount of time and expense. The guide is snugly encased in stout plastic jacket.

The Guide is divided into two sections. The first section is entitled TROUBLE and it lists the code number for various observations, each with the corresponding trouble or troubles.

The second section is entitled DEFECTS and it deals with the origin of the various troubles.

The two sections are interlocked through a unique numbering system, which makes the use of the Guide extremely convenient.

The TROUBLE section carries code numbers in the left side column. These numerals correspond to those of the Trouble Spotter attached to this booklet.

The second column lists supplementary observations which help to diagnose the trouble or to select the correct one if one code number allows more than one.

The third column lists the probable troubles corresponding to their code numbers.

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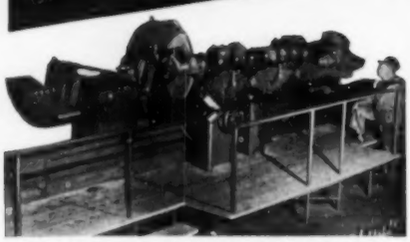

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PILOT INJECTION

. . . continued from page 57 . . .

dual pressures in the fuel line, cannot reopen once it has shut on the termination of injection, before the next pumping cycle. Hence the pressure wave set up at the nozzle by the closure of its valve becomes almost completely reflected at the closed delivery valve, and travels forward again to the nozzle. This may have sufficient intensity to reopen the nozzle, particularly if it is set at a low opening pressure as in the present instance. Complete reflection of pressure waves at the delivery valve is avoided by the special construction of the valve designed for use with pilot injection equipment, shown in Figure 4. During the forward flow of fuel from the pump to the nozzle, the valve offers little resistance, since the small plate valve (A) is free to lift off its seat. When the pump pressure falls at the end of injection, reverse flow causes the valve (A) to reseat, but unloading of the pipe line proceeds by opening of the larger annular valve (B) downwards against the spring (C). This valve will remain open until line pressure has fallen to the pressure determined by the spring loading. Pressure waves arriving at the delivery valve will therefore not be completely reflected even if this return flow valve has temporarily shut, and so the intensity of return pressure waves arriving at the nozzle will be considerably reduced, and will not be sufficient to reopen the nozzle. Fuel line pressure diagrams taken near the nozzle in fact show remarkable freedom from the usual succession of pressure fluctuations following the termination of injection. Reviewing the system as a whole, while the equipment is rather more expensive than the normal pump and injectors, owing to the additional production operations and special parts required, this will be offset by the advantage of smoother and quieter running engines to be obtained.

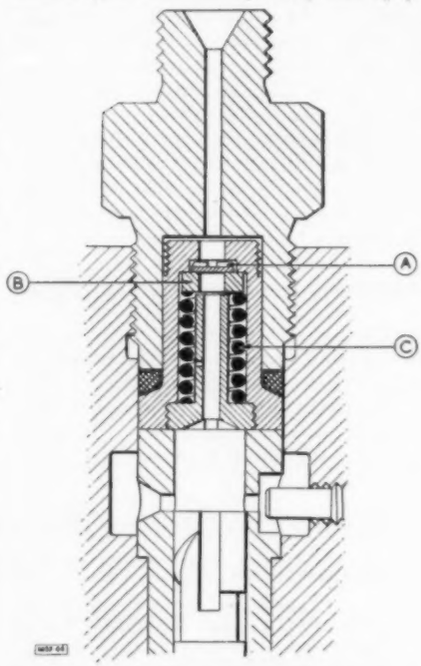


Fig. 4. Arrangement of injection pump delivery valve.

Cylinder indicator diagrams show that the usual high rate of pressure rise following the initiation of combustion has been replaced by a smooth transition from the compression curve.

Figure 5 is a typical cylinder pressure diagram which demonstrates this point, a diagram for the same engine with normal injection being superimposed on the pilot injection diagram for comparison. Figure 6 shows typical injector needle valve lift diagrams for normal injection (left) and for pilot injection (right). These diagrams were obtained as oscillograph records from the C.A.V.-Ricardo photo-electric indicator, which enables minute movements to be indicated with great accuracy. The opening of the needle corresponding to the first portion of the cam lift is very clearly shown. Fuel injection rates are illustrated in Figure 7, in which are plotted the results obtained by means of injection rate analyser apparatus specially developed in the C.A.V. diesel laboratories. The apparatus enables direct measurement to be made of the amount of fuel delivered by a nozzle during each degree of crankshaft rotation. The full line shows delivery in cubic millimetres per degree of crankshaft rotation for pilot injection, and the relative standard rate diagram is superimposed as a dotted line for comparison. On the C.A.V. stand at the New York Show this analyzing apparatus was demonstrated together with fuel spray from a pilot injection nozzle as seen with aid of a stroboscope.

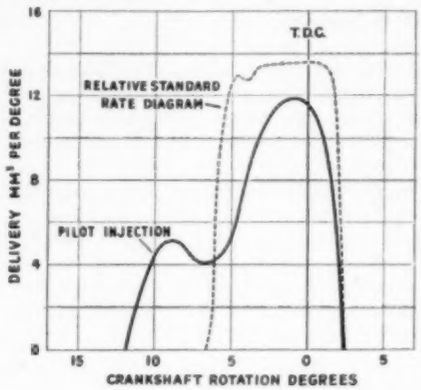
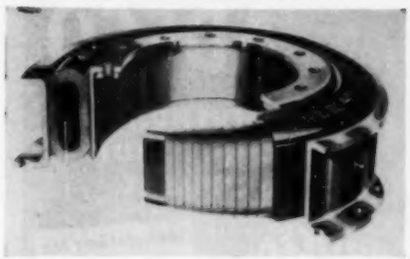


Fig. 7. Curves showing fuel injection rate for pilot injection (full line) as compared to the normal rate for standard type injection (shown dotted).

More Diesels for Penn Railroad

The first unit of a fleet of seven diesel-electric switching locomotives for yard and local freight service in the South Amboy district was placed in operation last month, for the Pennsylvania Railroad. Upon completion of delivery of the additional units, each of 1,000 hp., the Pennsylvania's freight operations in this area will be fully dieselized. The new locomotives will serve the coal dumpers and supporting facilities at South Amboy and, in addition, will be used in local freight service over the branch lines to Hightstown and Freehold, as well as via New York & Long Branch R.R. between South Amboy and Bay Head Junction.

New Design by Falk Airflex



The Falk Airflex Coupling has recently been redesigned after ten years of outstandingly successful service in the most difficult coupling applications. Improvement in rubber composition and bonding have increased the torque capacity 20 per cent above previously published values while the hubs and adaptor plates have been redesigned to facilitate disconnection and removal of the entire gland assembly. Redesigned components are entirely interchangeable with the equivalent components of all Airflex Couplings now in use and standard parts may be combined to allow six different mounting arrangements including flange mounting on a flywheel. Stiffness factors can be controlled and are available for torsional analysis. This coupling is designed primarily for engine drives and for applications involving extremely severe torque fluctuations. The coupling is fully described in Falk Bulletins 8100 and 8105, which have just been released.

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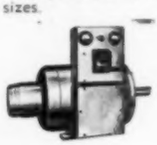

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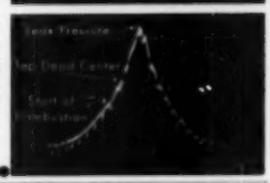
RESULTS OF DIESEL LOCOMOTIVE "FULL LOAD TEST"*

	COND. 1	COND. 2	COND. 3	COND. 4	COND. 5
Start of Fuel Injection	29° BTC	26° BTC	26° BTC	23° BTC	21° BTC
Maximum Horsepower	1040	1056	1073	1084	1026
Start of Combustion	12.5° BTC	7.5° BTC	4° BTC	3.5° BTC	3° BTC
Location of Peak Pressure	0° ATC	10° ATC	12° BTC	12° ATC	12° ATC
Maximum Firing Pressure	980PSI	920PSI	872PSI	880PSI	845PSI

*Data courtesy of COOKITE RING SALES CO., Chicago.

This photo shows conditions at start of test. (Condition No. 1.)



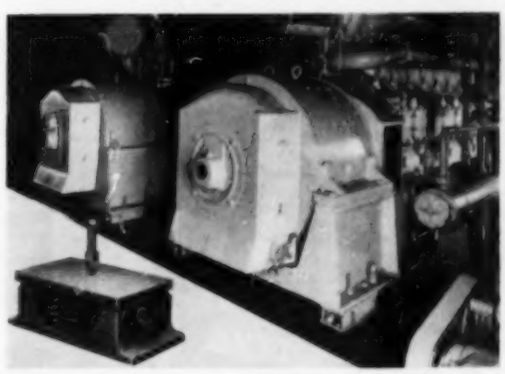
This photo shows optimum injection and peak pressure timing for this engine. (See condition No. 4.)

DIESELS for operating ECONOMY

The present day trend toward diesels — both for new installations and for replacements — is largely due to operating economy and dependability.

Current installation practice is to mount them on Korfund Vibro-Isolators.

This makes it possible to install diesels *anywhere* with positive assurance that there will be absolutely no transmission of objectionable vibration. Additional benefits include savings from reduction of building and engine maintenance costs, and frequently the elimination of concrete foundations.



A pair of Nordberg four-cycle, six cylinder, 9" x 11½", supercharged diesel engine generating units, installed, for smooth operation, on Korfund Steel Spring Vibro-Isolators.

Vibration is absorbed by steel springs which provide the finest isolating medium available. Thrusts are controlled by resilient chocks in the four corners.

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Namm Department Store, Brooklyn
4 300-hp.; 1 180-hp.; 1 150-hp. Worthington
Macy's, New York.....1 700-hp. Alco
Floyd Bennett Field, New York.....1 450-hp. Fairbanks-Morse
Prudential Insurance Co., Newark, N. J.....1 740-hp. Baldwin
Lone Star Gas Co., Dallas, Texas.....1 400-hp. Cooper-Bessemer (Gas)
Sun Oil Co., Marcus Hook, Pa.....4 250-hp. Ingersoll-Rand (Gas)
Cia Central Argentina De Electricidad, Buenos Aires, S. A.
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WEST COAST DIESEL NEWS

By **FRED M. BURT**

USED as a freighter on the Pacific Coast since the war, the former Navy YP *Explorer*, powered with a 560-hp. Union diesel (two 200 hp. Union diesel auxiliaries), has been purchased by Joe Soares, San Diego tuna clipper owner and skipper.

SUPPLIED by Anderson-O'Brien Co., Los Angeles, for Hughes Aircraft Co., Culver City, a portable power unit mounted on a small trailer, to be used for power and lights in areas away from regular power outlets. The self-contained diesel-generating set is composed of 6-cyl. 165-hp. General Motors diesel and 50-kw., 200-volt Electric Machinery Co. generator. A small transformer supplies 110-volt current for lights.

TO BE powered with Buda DCMR-2505 model marine diesel engines, three 65-ft. British Columbia fishing vessels are on the ways of Sterling Shipyards, Ltd., for May, 1950, completion; two for Canadian Fishing Co., one for Frank Tomasich.

BERG Metals Co., Los Angeles, has converted a second Brown Hoist railroad crane, used in their yard for handling scrap metals with a magnet, from steam power to diesel, using a D318 (100-hp.) Caterpillar diesel (from Shepherd Tractor & Equipment Co.), with Twin Disc torque converter.

THE *Golden Star*, a K-38 Kettenburg Boat Works,

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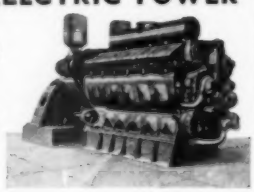

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San Diego, Albacore boat recently completed for Frank Stanovich, John Oreb, and M. Maturich, San Pedro, is powered with a 3-cyl. General Motors diesel with 3:1 G.M. reduction.

SHIPMENTS abroad of Hallet diesel engines include quantities of 1-cyl., 8-hp. units to be used for lighting Turkish Airways airfields; to the Jugo-Slav government twin-cyl., 18-hp. Hallet diesels for use in the mining industry.

ORDERED from Kenworth Motor Truck Distributor, Los Angeles, 30 new Kenworth, cab-over-engine, 114-inch wheelbase tractors powered with Cummins HRBS 225-hp. diesel engines, by Pacific Freight Lines, Los Angeles. Following design ideas of PFL's Lennon Duntley for short power unit to pull two 24-ft. semi-trailers and be within California highway length limits, a pilot model had been in use for many months.

RE-POWERED with a new D315, 53-hp. Caterpillar diesel with 3:1 Twin Disc reverse and reduction gear, was combination fishing boat owned by A. Falconi, San Pedro.

ENGINE Sales & Service, Los Angeles, has been appointed Southern California distributors for the new P & H (Harnischfeger Corp.) lightweight, high speed diesel engines designed for extensive use in construction fields; 1, 2, 3, 4 and 6 cylinder engines, from 24 to 145-hp. W. A. Styles is West Coast manager for Harnischfeger, with office in San Francisco.

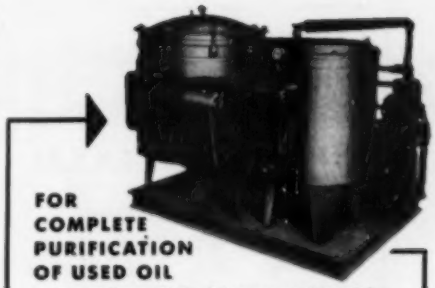
A. L. BROSIO, long prominent in West Coast tuna fishing activities, has been promoted to the position of vice president and general manager of National Steel and Shipbuilding Corp., San Diego, one of the West Coast's largest producers of diesel-powered fishing vessels. C. Arnholt Smith, president, also announced appointment of Ray Fox, former General Motors and Moran Towing Co. official, as executive vice president of National.

MONTEREY type 30-ft. fishing boat *San Antonio* has been powered with a 4-cyl. Model 129 Pacific diesel (from J. T. Siler Co., Wilmington), with 3:1 Snow-Nabstedt reverse and reduction gears; for owner Nick Travsani, San Diego.

PURCHASED by V-C-K Construction Co., Los Angeles, for use on Redondo Beach sewage contract, to replace a gasoline engine, powering a Parson's Ditcher, an 80-hp. D318 Caterpillar diesel engine. (From Shepherd Tractor & Equip. Co.)

INTALLED by H. G. McKinney Co., Wilmington, Calif., in the 38-ft. *High Seas*, owner, Walter Ficken, Orange, Calif., a Model 4FS1, 1-cyl. Nordberg diesel engine.

RETURNED to Terminal Island for complete overhaul, converted shark boat, 104-ft. *San Marcos* (ex-ARP vessel), Bob Walsh, skipper, is powered with three 671, 165-hp. General Motors diesels, with 3:1 Western Gears. All machinery on the *San Marcos* is electrically driven by G.E. motors.



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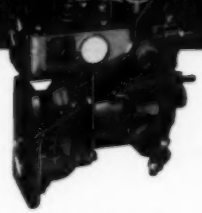

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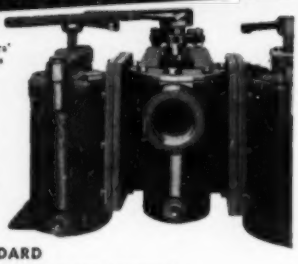

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ADVERTISERS' INDEX

AC Spark Plug Division, General Motors Corp. 17
Adeco Products, Inc. 94
AEC Southall Diesels 86
Aerofin Corporation 94
A.C.V. Sales Ltd. 86
Associated British Oil Engines, Inc. 32

Bacharach Industrial Instrument Co. 85
Brown & Sharpe Mfg. Co. 85
Buchi, Dr. Alfred J. 21
Burgess-Manning Co. 63

Campbell, Wyant and Cannon Foundry Co. 85
Chicago Metal Hose Corp. 80
Cities Service Oil Co. 19
Cleveland Diesel Engine Div., General Motors Corp. 14
Columbia Electric Mfg. Co. 92
Cooper-Bessemer Corp. ..... Fourth Cover
Crofton Diesel Engine Co., Inc. 9

DeLuxe Products Corp. 72
Detroit Diesel Engine Div., General Motors Corp. 4
Diamond Chain Co., Inc. 78
Diesel Plant Specialties Co. 94
Diesel Technical Service, Inc. 94

Electric Auto-Lite Co., The 51
Electric Machinery Mfg. Co. 8
Electro-Motive Div., General Motors Corp. 2
Electro Products Laboratories, Inc. 93
Elliott Company ..... Third Cover
Engineering Controls, Inc. 81
Enterprise Engine & Foundry Co. 71
Erie Forge Co. 28

Fairbanks, Morse & Co. 18
Fitzgerald Manufacturing Co., The 96
Fulton Iron Works Company 83

General Motors Corp.
- AC Spark Plug Div. 17
- Cleveland Diesel Engine Div. 14
- Detroit Diesel Engine Div. 4
- Electro-Motive Div. 2

Griscom-Russell Co., The 27

Harnischfeger Corp., P & H Diesel 7
Hemphill Schools, Inc. 91
Hercules Motors Corporation 26
Hilliard Corporation, The 85
Honan-Crane Corp. 83
Hunt-Spiller Manufacturing Corp. 29

International Fermont Machine Co. 30
International Harvester Co. 16

Johnson Bronze Co. 67

Kato Engineering Co. 93
Koppers Company, Inc. 22
Korfund Co., Inc., The 93
Kraissl Company, Inc., The 96

Lanova Corp. 94
Leece-Neville Co., The 68
Lima-Hamilton Corp. 6
Lister-Blackstone, Inc. 74

Mack Trucks, Inc. 12
Madison-Kipp Corp. 23
Magnus Chemical Co., Inc. 95
Main Supply Store 93
Mid-Continent Petroleum Corp. 84
Murray & Tregurtha, Inc. 82

National Forge & Ordnance Co. 94
National Welding & Grinding Co. 92
Nordberg Mfg. Co. 11
Nugent & Co., Inc., Wm. W. 77

Oakite Products, Inc. 90

Petrometer Corp. 94
Pierce Governor Co., Inc., The 95
Power Co., Inc., Edward M. 91
Purolator Products, Inc. 69

Russell, Newbery & Co., Ltd. 76

Schoonmaker Co., A. G. 94
Scintilla Magneto Div., Bendix Aviation Corp. 3
Sharples Corporation, The 75
Skinner Purifiers Div. of Bendix Aviation Corp. 79
Standard Oil Co. of Calif. 5
Standard Oil Co. (Indiana) 13
Standard Pressed Steel Co. 95
Sterling Engine Co. 87
Stewart & Stevenson Services 20
Sticht Co., Herman H. 95
Struthers Wells Corporation 94
Synchro-Start Products, Inc. 24

Texas Co., The ..... Second Cover-1
Thomas Flexible Coupling Co. 65
Tide Water Associated Oil Co. 73

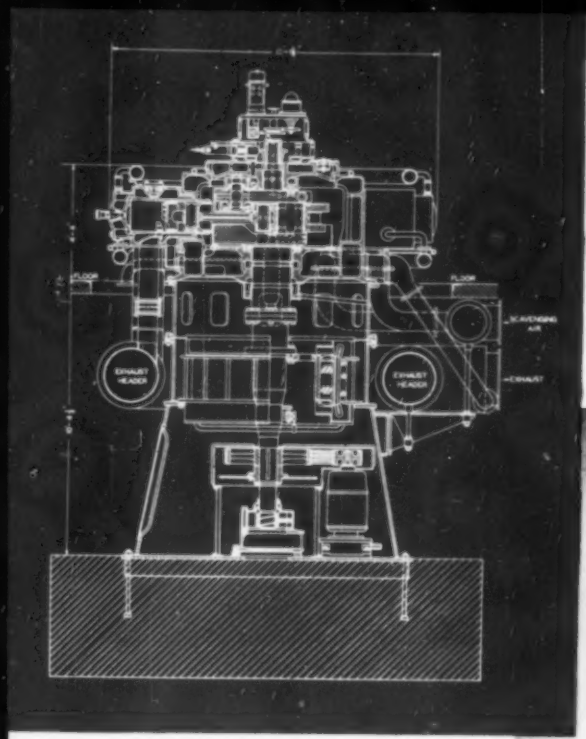
U. S. Hoffman Machinery Corp. 95

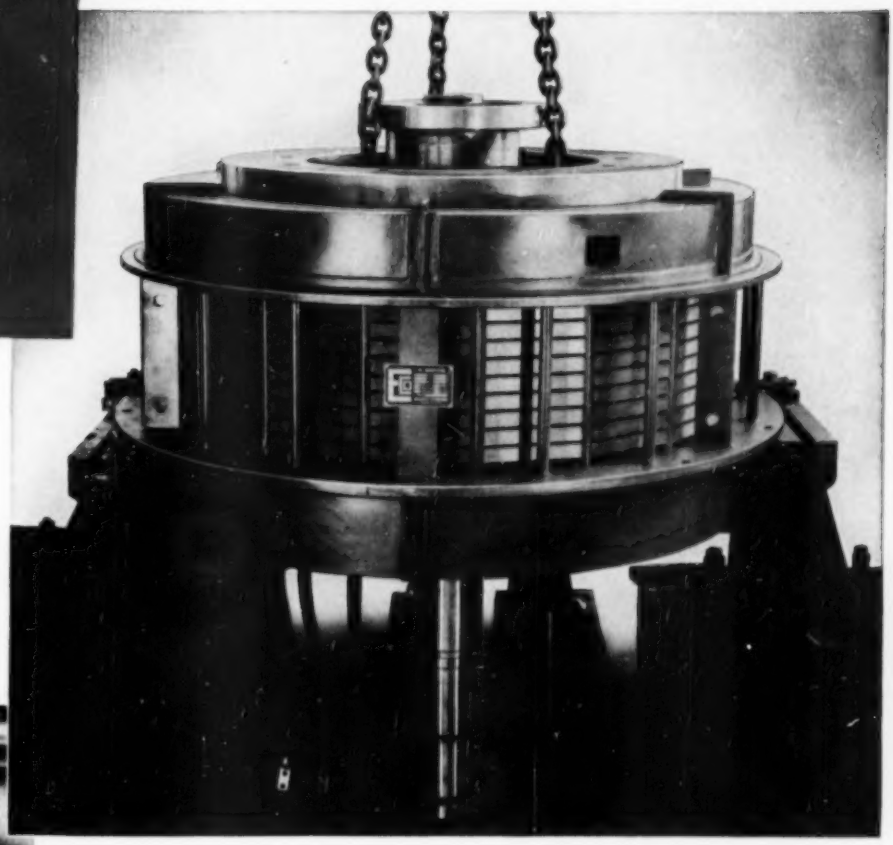
Vogt Machine Co., Inc., Henry 61

Walworth Co. 10
Westinghouse Electric Corporation 25
Winslow Engineering Co. 70

Young Radiator Co. 79
Youngstown-Miller Div., Walter Kidde & Co., Inc. 15

Vertical generator *by* ELLIOTT

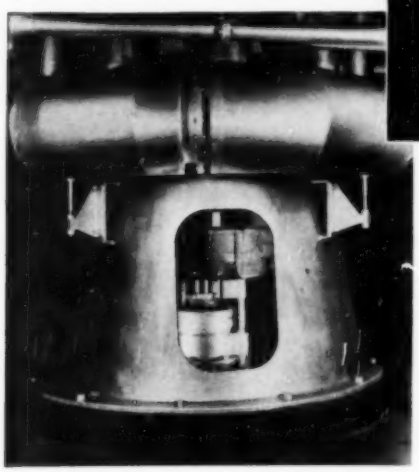




At top: Sectional drawing of 14" x 16" Nordberg radial Diesel engine and Elliott vertical synchronous generator.

At right: The generator ready for shipment. Note all-welded steel construction.

Below: Engine steel base which also houses vertical generator. Engine exhaust header surrounds base. Exciter is seen through opening in base.



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Bulletin PB-2000-2 gives a very complete story on this new generator. Mailed on request.

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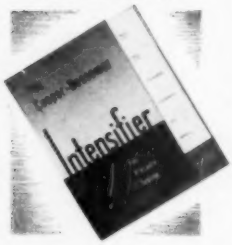

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